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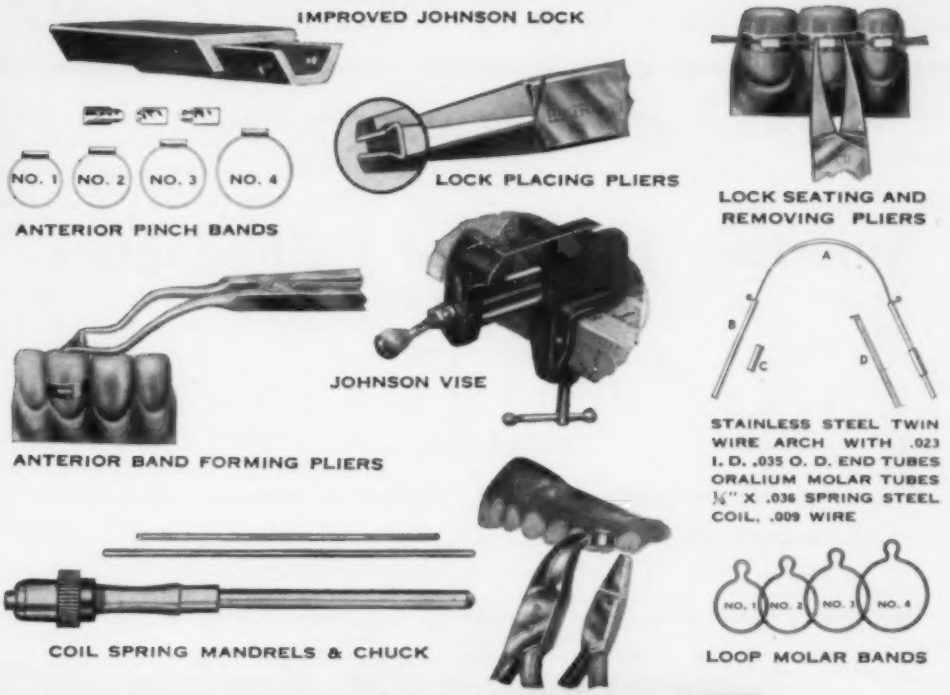

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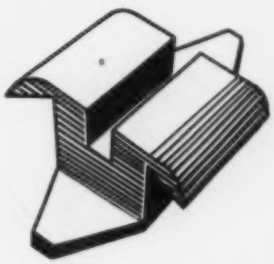

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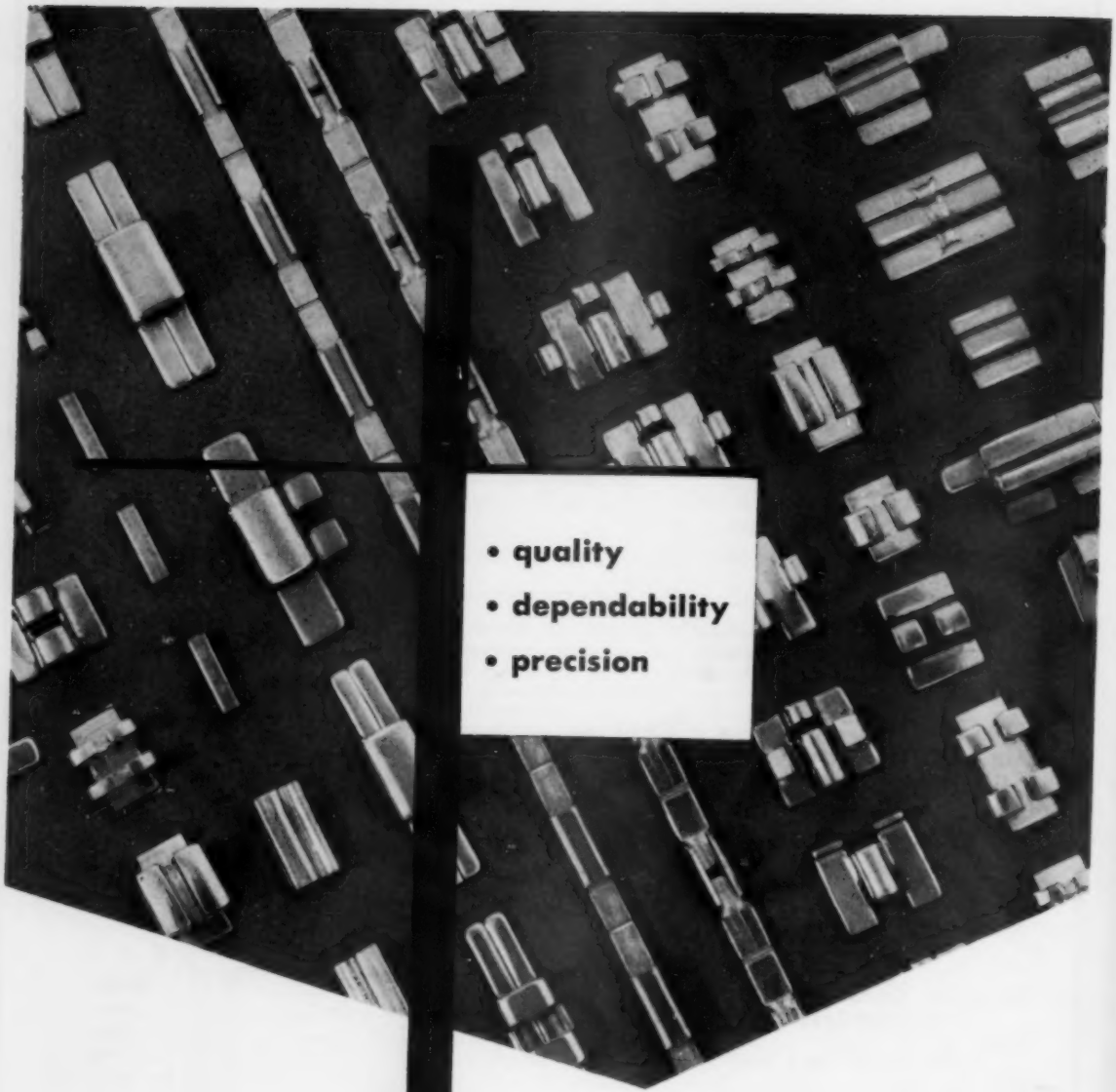

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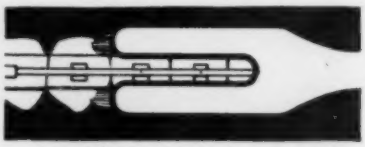

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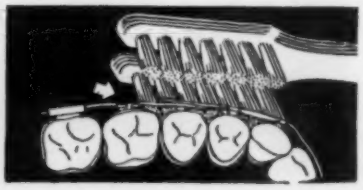

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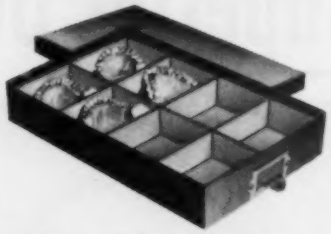

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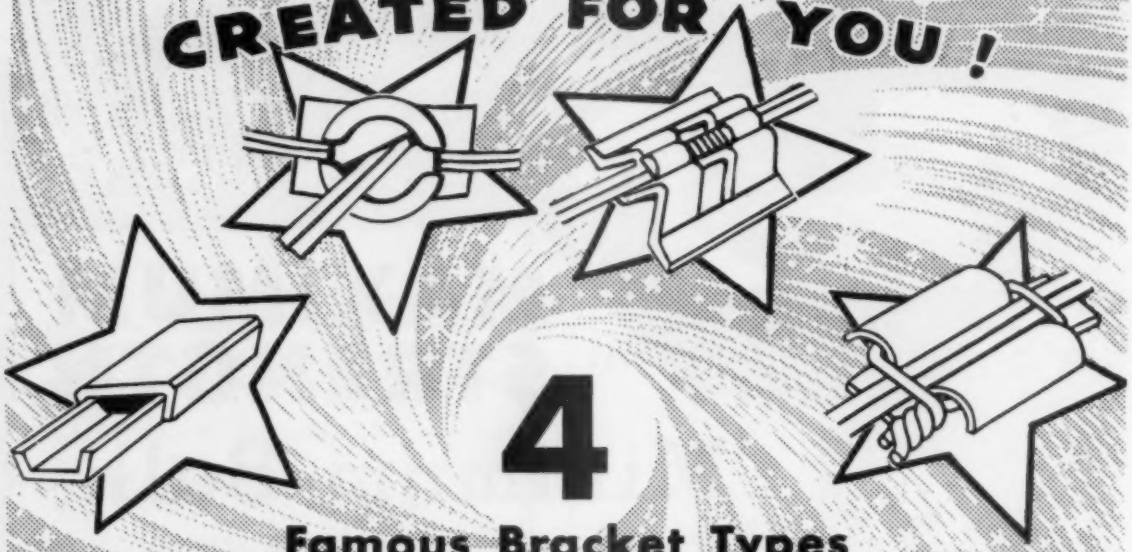

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American Journal
of
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VOL. 39 AUGUST, 1953 No. 8

Original Articles

SIMPLIFYING OUR ORTHODONTIC PROBLEMS

CLIFFORD L. WHITMAN, D.D.S., HACKENSACK, N. J.

THE heart-warming and keen interest that was shown in my article, "Habits Can Mean Trouble" (AM. J. ORTHODONTICS 37: 647, 1951), plus its themes and variations, has prompted me to go into the subject still further. I certainly do not want to be dubbed as being able to speak only on habits. I shall repeat certain portions of my previous article, with special emphasis on correction of improper tongue and swallowing habits, plus the therapeutic value of musical instruments.

It has been a common failing to overlook habits and perversions of muscular use in the treatment of orthodontic cases, and our first thoughts usually are, "What appliances should I use for this particular patient?" when we really should be thinking, "Why is an appliance necessary for this patient?" We are prone to be too quick to jump to conclusions. I fully agree that in many cases an appliance therapy is the one and only solution. However, we can simplify things for ourselves, and our patients, if we take the time, effort, and patience needed, and find out whether a detrimental habit has been, or is at present, a possible factor in producing the malocclusion. If so, we can discourage the bad habits with good habits. (Overcome evil with good.)

In correcting habits we have to be a combination of dentist, orthodontist, psychologist, and psychiatrist. We can cope with and correct these detrimental habits by thinking, listening, analyzing, and carefully observing the patient, and, if possible, his parent or parents. However, are we not all creatures of habit? Even inanimate objects are creatures of habit, i.e., a piece of paper drops into the same pattern as it had folded previously, a garment worn a while soon clings to the shape of the body, and a lock, after a little use, will turn much easier. We eat, we sleep, we brush our teeth, and we get dressed

Presented before the Northeastern Society of Orthodontists in Montreal, Canada, November, 1952.

for work. Why do we do all these things? Just habit. But these are *not detrimental habits.* These are constructive habits that save time and thinking. We all have some bad habits, which could be substituted with good habits. The reason that I mention our adult habits is that I think it will help us to have a better understanding of patients. We all have to be doing something, while we are doing something, i.e., munching on candy or popcorn, drinking, or smoking while looking at television or listening to the radio. The children, not being old enough to smoke and drink, stick to old-fashioned nail biting and thumb-sucking. I am listing some of our everyday habits or mannerisms, and I am sure that each one of us is guilty of at least one of these silly habits. Yes, I am on the list. I do not smoke or drink, but I am an expert on breaking wooden stirrers and chalk, winding and unwinding telephone wires, and doodling.

We can check our patient's habits, by careful observation when we are getting the first information. Direct your questions to the patient (even the very young patient) rather than to the parent, because you then will have a chance to observe whether he is using his tongue normally, and whether there is a lisp present. Also, if you are talking directly to the patient, you will be able to notice his nails and fingers.

THE TONGUE, IMPORTANCE OF CHECKING ON SWALLOWING AND IMPROPER POSITION

1. Most open-bites are not a deformation of skeletal pattern.

2. Most open-bites are the result of perverted use of the tongue in swallowing.

3. The tongue in normal swallowing is in such a position that the dorsal surface is in contact with the hard and soft palates, exerting its pressure against them in an upward and lateral direction. Its tip and edges do not protrude between the teeth at any point. The tip of the tongue does not come forward any further than the lingual gingival margin of the maxillary incisors, and it does *not* rest on the incisor teeth. (Swallow, and see what takes place in your own mouth.)

In open-bite cases the tongue does *not* arch up in the palatal vault, but lies flat in the mouth. Due to this lack of arching, it needs more room laterally and, therefore, protrudes anteriorly and causes the maxillary incisors to be pushed forward, upward, and outward. In some cases the tongue extrudes laterally between the buccal teeth, and the open-bite is produced in one or both of the buccal segments. There are many combinations and variations.

How is this habit developed? My ideas on this point, which are supported by clinical observations and deductions, are that one of the most common causes of improper use of the tongue starts with improper bottle feeding. The average artificial nipple is three-quarters of an inch to an inch and a quarter in length. I doubt if its counterpart can be found in the female of the species. (That would be an interesting research project, and all in the line of research.) The long artifical nipples, with holes too big, fill the infant's mouth. The nipple extends back into the area of the soft palate. He does not have to do much sucking. The milk just flows out without much effort or work on his part. He

does not have to raise the dorsum of his tongue or use his lips very much. (Place the tip of your tongue on your incisor teeth and fuss with the tip of your tongue. Your teeth are in the same relative position as the infant's gum pads. I think you will discover that you could do a job on a long rubber nipple. If you happen to have one in your pocket try it; if not, try your finger.) Many infants start life this way, and they never have a chance to learn to suck and swallow properly, so we readily can see how improper swallowing starts, and how, many times, it is in conjunction with thumb-sucking—a vicious circle, which the innocent baby had no part in starting.

We must be patient in the correction of these habits. When the child has swallowed improperly for many years, we cannot expect to undo everything in a few weeks.

Before I list the general directions for retraining the tongue and swallowing, I want to say that I have heard via the grapevine that I *poke the roof of the patient's mouth with a sharp instrument until it bleeds.* When I first heard this, I thought it was a joke, but if this is being done it is not much of a joke for the patient. What I actually said was, "Take an instrument and use enough pressure so the patient will know where the piece of Life Saver is to be held."

General Directions for Correction of Improper Swallowing and Tongue Perversion

1. Have the patient hold a mirror so that he can watch himself.
2. Have him swallow as he normally does, then show him how his tongue comes between his teeth. Use everyday language that the patient will understand. (*Speak to the patient as a friend and not as a censor.*)
3. Now take a small, irregular piece of Life Saver, Sen-Sen, Charms, or even a small piece of wax.
4. Now take a *blunt* instrument and tap the posterior part of the hard palate, in the midline, about one-eighth of an inch anterior to its posterior border. In this way, the patient will know where the Life Saver is to be held.
5. Place the small piece of hard candy on the dorsum of the tongue. When the tongue is relaxed and contained within the boundaries of the lower teeth, the piece of candy should be in line with the distal surface of the last erupted mandibular molars (Fig. 1).
6. The patient then is told to hold the piece of Life Saver on his tongue as you have placed it; then to place it against the spot on the roof of his mouth that you just poked with the blunt instrument.
7. The patient will see that his tongue does not protrude between the teeth if this is done properly.
8. If the swallowing has been done improperly on the first try, the only casualty will be that he will swallow the small piece of Life Saver.
9. Start over again and have the patient sit and practice this for a while before he is dismissed.
10. Go over these directions carefully with the parent, because the patient will need your help and encouragement. You will find that in an open-bite

case that is due to a perverted tongue habit the bite will close considerably in a few weeks' time if the training is practiced. If the patient has a lisp it also will help overcome that.

11. Speech training, especially the mechanics of sounding *S*, *T*, and *D*, is of great help in tongue habits. Here are the general directions for correction of thumb-sucking and nail biting. (It should be remembered by all of us that we only aid the patient; he does the actual work.)

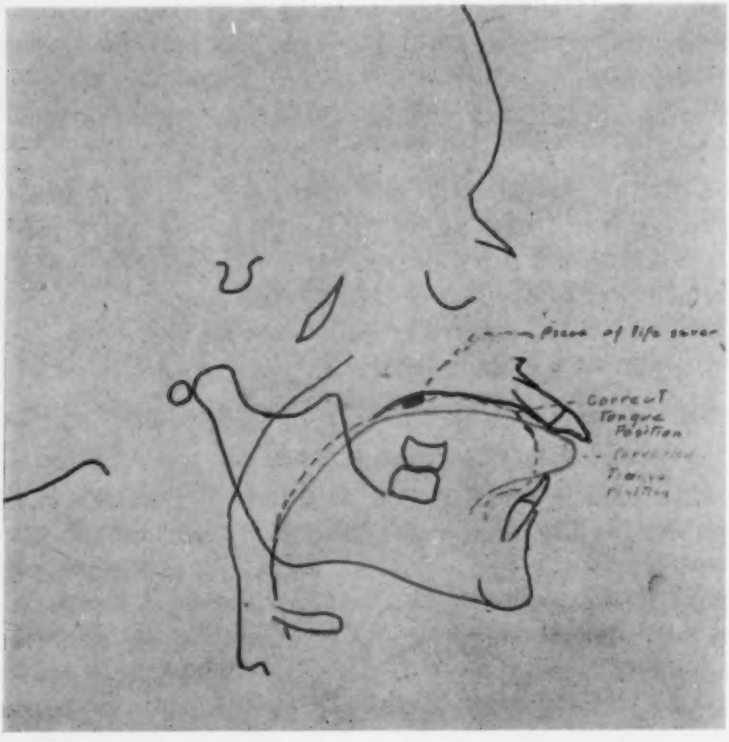

Fig. 1.

General Rules or Directions for Helping the Patient Overcome Thumb-Sucking or Finger-Sucking

1. After routine examination takes place and the patient has told you that he sucks his thumb, you say, "You mean you did as of last night, but you are all stopped now." The patient usually will look very happy and elated over this statement.

2. Tell the patient you have some lotion which does not taste too good but that, on the other hand, it does not taste too bad, and it really does not do anything but remind. Ask him if he would like a bottle of it, *but ask him as you are handing it to him.* (Only about one out of ten will say no, *if the proper presentation is made.*)

3. Then tell the patient, "We also have some Magic Pills and these pills are really magic." Explain that you do not know exactly how they work, but you do know one thing for sure, and that is that they *do work.* They will remind the patient not to put his fingers or thumb in his mouth while he is asleep.

(We give six tablets *only* of ¼ or ½ gr. colored phenobarbital and we type on the envelope, "One Magic Pill ½ hour before bedtime with a light snack." It should be mentioned that the reason a light snack is advised before bedtime along with the medication is that in many cases where I have joked about a patient being so hungry he had to eat fingernails or thumbs or finger, the child actually has said that he was hungry at night and that the parents would not allow him to eat before going to bed. Therefore, the extra food plus a mild sedative, or the little extra attention the patient receives when he gets the food helps a great deal in getting the habits under control.)

4. Hand the patient the little set of miniature teeth and say, "If you still feel you have to put your finger or thumb in a mouth use this mouth, because you can't hurt this mouth."

5. Next, photograph the patient's teeth and give him an appointment to come back and see how much his teeth have moved. In an extreme case make the appointment within three or four days if possible, but never allow longer than one week before the next visit.

6. Give the patient a little plaster animal or plastic toy, which will be another reminder of you and a pleasant visit to your office.

7. Then mail the patient an American Dental Association Pinocchio certificate (Fig. 2), because that will be an additional reminder for the next day.

Fig. 2.

8. Explain to the parents that, aside from giving the Magic Pills, they must not make an issue of the habit. Ask them to leave the job up to you. In most cases you will find you get good cooperation.

9. It also has been found that patients between the ages of 7 and 10 often will write to you and tell you their problem is under control, so in some cases, you will say "Why not drop me a note and tell me how well you have done?"

This time consumed in correction of habits is not wasted time because, if we depend on metal spikes, spurs, and other medieval devices for the correction of the habits, we too often will have relapses when the devices are removed. Surely, we orthodontists have enough common sense to know that we might

temporarily remove the habit, but what will be the effect? It would be my idea that in order actually to get the feel of such a habit-breaking appliance, it would be wise to have one in our own mouths for a few days before we try to place one in the mouth of a little child.

It has been found that many of the older children who suck their thumbs and bite their nails were stopped from normal sucking when they were infants by means of splints on the arms, bitter aloes, or other cruel means.

The question often arises as to how early I start to stop habits. The answer is, as soon as we find out it is a fixed habit, which is usually after the patient is 3 years of age. At that young age we do not give either lotion or sedative. We merely get acquainted and have the patient in every few weeks. After the "get-acquainted stage" we start to show him actual protrusion cases, usually colored photographs, and it is surprising how he will begin to notice he should not put his fingers in his mouth. We tell him to hide his thumb at night (close fingers over thumb). We ask the parents to get the patient a cuddly animal or doll, to lie down with him a few minutes, and tell him a story or sing to him. Another simple aid in correction of nail biting, thumb-sucking, perverted tongue habits, etc., is just to teach the patient plain old-fashioned whistling. It is fun for him and he will cooperate readily with you. It is a simple remedy, but, stop and think, the patient cannot be practicing any of the previously discussed habits while whistling.

Nail Biting

Follow the same general directions and ideas used for thumb-sucking and:

1. Photograph the nails (preferably with colored film).

2. Give the same envelope of Magic Pills, but have the patient take one pill before dinner and one pill one half-hour before bedtime with a light snack.

3. Give the girl patient the Reminder Lotion in a bottle with a nail polish brush, and it will look like colorless nail polish when she applies it.

4. For boys use a plain bottle with a glass applicator and have them use it just over the tips of the fingernails.

5. Compliment even the slightest improvement in the patient's nails.

6. Allow a week or two before the next visit to give the nails a chance to grow.

7. Give the same miniature teeth and tell the patient if he still has to bite his nails to use the little teeth instead of his own.

8. Instruct the parents not to mention the subject of nails unless it is a compliment of some kind.

9. Give the patient a little puppet (which can be made in the office) to keep his fingers busy (especially while watching television). (Gum chewing helps too.)

10. Last, but not least, if these methods fail to help, and they do occasionally, just tell the patient that you are sorry that you were not able to help him and that you feel bad about the whole thing and say, "There isn't any use

giving you another appointment, and I surely will miss seeing you, but when you have things under control, will you call me for another appointment?''

Children are unpredictable, they have their good days and their bad ones, just the same as we have good days and bad ones at the office, so do not be too harsh or stern. It just does not work on the patient and you will only make things more difficult for yourself.

The suggestions that have been presented to help control thumb-sucking and nail biting work very well for most habit cases. (Nail biting is the more difficult of the two to correct, because in many cases it seems to be just a necessary part of growing up.)

It often has been stated that nail biting is a sign of frustration. (Frustration means the prevention of an act which, if carried out, will produce gratification.) I am sure that we all agree on that point as far as some individuals are concerned, but I am sure also you will agree that every child who bites his nails is not frustrated. For example, there is the hellion type of nail biter, who bites his nails to get his own way, and to obtain something extra from his parents. He will stop biting when he gets his own way, but when he is balked he will start in again until his immature mother, who is bewildered as to what real love and affection mean, is so beside herself with lack of knowledge that she gives in to every demand, only to regret it as the child grows older. This progressive type of nail biter, whose natural inclinations must not be interfered with lest he develop frustrations, is usually hopeless because he has had improperly directed affection and security. He wants and he gets, and he has not learned that we have to give and take. This type of patient is one who probably would drive a psychiatrist nuts.

I have had several of this type and I have told them not to come back until the habit was corrected. One patient I had responded immediately to treatment (or so I thought) and his nails showed much improvement so, naturally, I was pleased until I found out he had received a new bike from his mother. He had the bike just a few weeks and back he went to nail biting worse than before. I tried to find out why and he told me, without any hesitation, that he wanted new gadgets for the bike, and he informed his mother and me that he intended to keep right on biting until he got what he wanted. The mother looked at me and said, "Now, what would you do?'' I said, ''Let him keep on biting.'' I know when he shows up again his open-bite will be worse, but if his parents cannot handle him and if he continues to dominate them, all right, but he is not going to have the chance to pull the same trick on me.

One other hopeless case is a boy who moved from Brooklyn to Hackensack (a distance of 14 miles) and so far, in a three-month period, the boy has had three television sets. The mother advised me that she was giving into the boy so that he would be adjusted. He needed the adjusting because they moved from an apartment to a large house. She was very serious in telling me that she was doing everything possible to keep him happy and to see that he would not end up frustrated. The dentist who referred him to me wrote a little note in which he said, ''I am very happy that he is in your hands instead of mine.''

The mother is aware that he is damaging his mouth and also that when his case is started it will take longer and cost more, but that does not seem to make any difference right now. I hope that he will move from Hackensack to Brooklyn before treatment is started, so that I can happily refer him back to where he came from.

Colored movies were shown which demonstrated the therapeutic value of musical instruments, which should not be overlooked by orthodontists. Watch closely the next time you see an orchestra, whether it be in person or on television. Notice the tremendous pressure the lips exert. Some of the musicians may have malocclusions, but I am sure that you will not find any gross facial deformities due to tooth irregularities. It must be remembered that singing, humming, and whistling are God-given aids to orthodontics.

Many times the simple solutions or aids which nature has laid right in our laps are overlooked. Just about every young child will enjoy learning to whistle, and this accomplishes two things, exercise of the lips and keeping the child occupied.

The following case reports explain how each case was treated and the possible reasons for the habits. It is of interest to note that each case is an individual case, and each case presented a different problem. The only similarity in the cases is that all the patients were bottle-fed, and for at least a year.

CASE REPORTS

CASE 1.—The patient, R., was an 11-year-old girl.

Diagnosis: Class II, right side; Class I, left side.

Birth: Normal.

Feeding: Bottle-fed at least one year.

Habits: Thumb from birth to date.

Nasopharyngeal conditions: Tonsils and adenoids removed.

Mental development: Above normal.

Vision: Normal.

Emotional stability: Good.

Personal habits: Excellent.

General health: Very good.

Social habits: Very active in Girl Scouts.

Treatment therapy: When the patient was first seen March 14, 1952, her mother said that all devices had been used since birth to control thumb-sucking but nothing had stopped the habit. She was told that her habit was a thing of the past. She was given a bottle of Reminder Lotion and told the lotion would not stop anything but only serve as a reminder. She was given an envelope of Magic Pills (six ½ gr. yellow phenobarbital) and a set of miniature teeth. Models and photographs were made of her teeth. I talked privately with her mother and found that her bedtime hour was 8 P.M. Her mother agreed to let her stay up until 9 P.M. On March 18, 1952, she again visited our office and the habit had stopped completely. It was almost unbelievable the amount her teeth had improved in four days' time.

Prognosis: Excellent. R. was seen every few weeks and at each visit there was a remarkable improvement. There has been no adverse reaction in stopping this habit which

had started at birth and had been a pronounced habit for eleven years. Simple orthodontic appliances now are being used to finish correcting the molar relationship on the right side, but did not nature do a good job in four months' time?

Fig. 3.

Fig. 4.

Figs. 3 and 4.—Case 1.

CASE 2.—The patient, J., was an 11½-year-old boy.

Diagnosis: Class II, Division 1 subdivision.

Birth: Normal.

Feeding: Bottle-fed at least one year.

Habits: Thumb-sucking from birth to date.

Nasopharyngeal conditions: Tonsils and adenoids to be removed.

Mental development: Normal.

Vision: Normal.

Emotional stability: Just fair.

Personal habits: Fair.

General health: Fair.

Social habits: (Information obscure.)

Treatment therapy: J. was first seen in August, 1952. His mother said he was hopeless and she had tried everything to stop his thumb-sucking. He said he would not stop the thumb-sucking until his mother stopped biting her nails. This type of conversation went on between the patient and his mother for about fifteen minutes. We finally got a word in and gave him the usual Reminder Lotion, Magic Pills, and miniature dentures. We also gave his mother a bottle of lotion for her nails (which, incidentally, was never used because she said biting her nails was her business). She was talked to privately while photographs were being made, but still contended that J. was a hopeless case.

Prognosis: Good, provided we can keep J.'s mother under control. He relapses occasionally, but his teeth are improving without the use of any appliance. J. is a very nice looking boy, and we have tried to build him up each visit because his mother is constantly nagging at him. His mother and father are divorced and she is always telling him he is just like his father. In this case, it is felt that we not only are getting J.'s teeth corrected, but we are gradually getting his mother to nag less and understand more.

Fig. 5.

Fig. 6.

Figs. 5 and 6.—Case 2.

CASE 3.—The patient, P., was a 9-year-old girl.

Diagnosis: Class I (open-bite).

Birth: Normal.

Feeding: Bottle-fed for fifteen months.

Habits: Thumb, tongue.

Nasopharyngeal conditions: Tonsils and adenoids removed at the age of 7. No pharyngeal reflex.

Psychogenic factors: Incorrect feeding is a possible factor.

Mental development: Above average.

Emotional stability: Tendency toward being irritable.

Personal habits: Excellent.

General health: Very good.

Social habits: Slightly on the introvert side.

Heredity: Mother and father of above average intelligence and child had excellent care.

Treatment therapy: P. was given Reminder Lotion and ½ gr. phenobarbital; photographs were made of the teeth. She returned in three weeks and the thumb habit had stopped entirely. She also had followed corrective swallowing exercises.

Fig. 7.

Fig. 8.

Fig. 9.

Figs. 7, 8, and 9.—Case 3.

Prognosis: Excellent; both parents gave us complete cooperation in aiding P. and helping her to remember the correct way of swallowing. The thumb habit had stopped after the first visit. Further photographs were made at the end of a six-week period and the bite had closed considerably.

CASE 4.—The patient, J., was a 7-year-old boy.

Birth: Normal.

Habit: Tongue and finger-sucking.

Feeding: Bottle-fed for eighteen months.

Treatment therapy: The patient was given Reminder Lotion and Magic Pills. Finger-sucking stopped immediately. He is now on corrective swallowing exercises. For a boy of his age he is doing very well.

Prognosis: Very good. Both J. and his parents are very cooperative.

The beginning photograph (Fig. 10) was made in July, 1952, the progress photograph (Fig. 11) was made in September, 1952, and the next progress photograph (Fig. 12) was made in December, 1952.

Fig. 10.

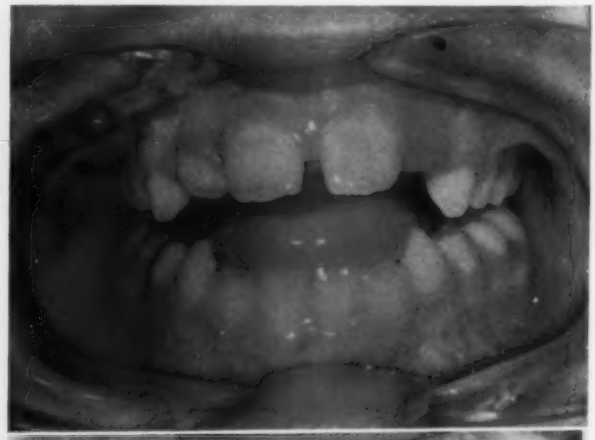

Fig. 11.

Fig. 12.

Figs. 10, 11, and 12.—Case 4.

CASE 5.—The patient was F., an 8½-year-old girl.

Diagnosis: Class I (open-bite).

Birth: Normal.

Feeding: Bottle-fed for about a year.

Habits: Thumb-sucking from birth.

Nasopharyngeal condition: Normal.

Mental development: Very good.

Vision: Normal.

Emotional stability: Good.

Personal habits: Very good.

General health: Good.

Social habits: Introvert.

Treatment therapy: F. was first seen in March, 1952. She was given Reminder Lotion, Magic Pills, and miniature dentures. She came in again in April; her habit had stopped at once, and had not recurred.

Fig. 13.

Fig. 14.

Figs. 13 and 14.—Case 5.

Prognosis: We hope very good. F. was in again in May with her aunt and her open-bite had closed very much. At that time her aunt was advised to have the maxillary frenum resected, but this was not done. Her mother has not taken any interest in her and at this point she will not allow her to come to this office or any other orthodontic office. F.'s aunt said she would bring her in again as soon as she was able to, as she is very much interested in her welfare.

Case 6.—The patient, M. L., was a 12-year-old girl

Birth: Normal.

Feeding: Bottle-fed for fourteen months.

Diagnosis: Class II (extreme open-bite).

Nasopharyngeal conditions: Tonsils and adenoids were removed at the age of 7. No pharyngeal reflex.

Fig. 15.

Fig. 16.

Fig. 17.

Figs. 15, 16, and 17.—Case 6.

The patient's brother is under treatment. M. L.'s mother brought her in to see if anything could be done for her (July, 1951). We put her on swallowing exercises (Life Saver), but did not take photographs on the first visit; when M. L. came back in after three weeks her bite had closed considerably. We then made photographs and a cephalometric x-ray. Her bite is closing slowly but steadily, and the molar relation is gradually improving. She is cooperating 100 per cent. Her case will be started as soon as her brother's is completed, as budget permits only one to be under treatment. However, I feel this is a case I would like to try out for another few months just on exercises, because she has made such splendid progress without appliances and it will be interesting to see how much can be accomplished without appliances. In most open-bite cases the first closure is the most spectacular as is the case in losing weight. (Usually the first week's weight loss is greater and the most noticeable.)

CASE 7.—The patient was S., a 9-year-old boy.

Diagnosis: Class II, Division 1 (extreme open-bite).

Birth: Normal.

Feeding: Breast-fed for seven months, bottle-fed from 7 months to 18 months of age.

Habits: Thumb-sucking which was stopped with guards (prescribed by family physician); then patient changed to sucking forefinger of right and left hands, mostly at night and when tired. His bite led to a bad tongue perversion and incorrect swallowing habits.

Diseases: Measles at the age of 6, average case; mumps at the age of 7, mild case.

Nasopharyngeal conditions: Mouth breather, infected tonsils which were removed two weeks after first visit to the office.

Fig. 18.—Case 7.

Psychogenic factors: S.'s mother started to work when he was 7 months old, at which time he was changed to bottle feeding. He was allowed to have the bottle until 18 months of age. He then was taken off the bottle and he switched to thumb-sucking. His mother became disturbed about this and used guards which stopped the thumb-sucking, but then he switched to the forefinger on the right and left hands.

Mental development: Normal, but extreme introvert.

Vision: Normal.

Hearing: Normal.

Speech: Lisp.

Emotional stability: Highly nervous.

Fig. 19.

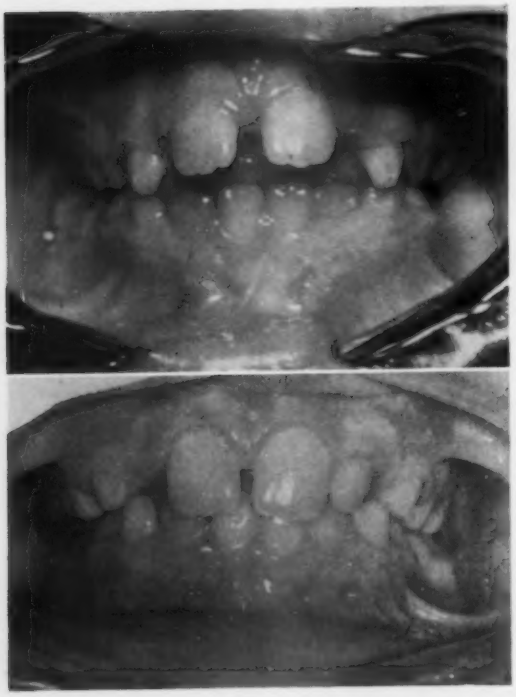

Fig. 20.

Fig. 21.

Figs. 19, 20, and 21.—Case 7.

Fig. 22.

Fig. 23.

Figs. 22 and 23.—Case 8.

Personal habits: Average.

General health: Fair.

Social habits: Extreme introvert, only child and not willing to mix with other children.

Heredity: S.'s mother seemed of average intelligence and she was most anxious to cooperate.

Treatment therapy: October, 1950, Reminder Lotion and ½ gr. phenobarbital were prescribed and much attention was shown to the patient. October, 1950, lotion and phenobarbital were discontinued. The patient had stopped finger-sucking. His tonsils were removed and he was put on corrective swallowing exercises. After a six-week period and a decided improvement in his open-bite a simple upper appliance was placed to close maxillary central space. He has a missing upper right lateral incisor.

Prognosis: Very favorable. The patient and his mother were very cooperative. At the time of writing he was on a rest period, but we saw him more frequently than would ordinarily be necessary because the attention he received in the office had changed his whole personality.

CASE 8.—The patient, M., was an 8-year-old girl.

Birth: Instrument.

Feeding: Bottle-fed for eleven months.

General health: Good.

Emotional stability: Just fair, another weeping female patient.

Psychogenic factors: Probably M.'s mother is a factor in this case.

Treatment: M. was given Reminder Lotion, ½ gr. phenobarbital, and little denture charms. On the way home the little dentures were lost. M.'s father called the office and asked that another set be sent as habit could not be stopped without little gold teeth. Another set was put in the mail. The post office did not hand stamp the envelope and they were broken. So, mother and father went to the post office and made them call my office and explain the situation in detail. The post office clerk asked us to please send another set. We referred M. back to her family dentist for the removal of the lower deciduous canine teeth. The family dentist mentioned that he had a slight cold. The patient came down with a slight cold and the mother refused to go back to his office because she said he might have started an infection in the spots where the teeth were removed. In fact, she was about to sue the dentist until she cooled down. The habit has stopped completely, and M. is seen regularly and her mouth is improving. We hope the case is self-correcting but, frankly, I do not blame the child for getting a little comfort from sucking her thumb.

Cephalometric x-ray (Fig. 22) shows open-bite. Progress cephalometric x-ray made three months later (Fig. 23) shows bite closing. Also, please note the molar relationship is almost normal.

CONCLUSION

We can simplify our orthodontic problems by remembering, "An ounce of prevention is worth a pound of cure." The medical societies, insurance companies, and dental societies are constantly teaching the public the value of preventive work. Surely, we orthodontists can apply the same preventive measures in our work. If we are to simplify our problems we, too, have to educate the public that it is easier to stay out of trouble than to get out of trouble. We must be more alert. We must watch for detrimental habits and substitute good habits. We must not say, "Come back when all the second teeth are in," "come back when he is twelve," or "thumb-sucking and nail biting don't cause trouble."

There is really no short cut to good orthodontic work, but the time spent with younger patients will *not* be wasted time. Preventive orthodontic work is progressive orthodontic work. We can guide these younger patients in the right direction. We all agree that orthodontic appliances are wonderful devices and we all agree that Mother Nature is wonderful. The two make a good combination. We can help nature with an orthodontic appliance if she lags a bit, but let us not try to solve all of our problems with gold and steel. They work well only when mixed with an ample dose of knowledge and good common horse sense. Let us treat the whole patient. We will have better results, fewer relapses and case failures, and greater peace of mind.

268 Moore St.

DESCRIPTION, CLASSIFICATION, AND ANALYSIS OF UNOPERATED CLEFTS OF THE LIP AND PALATE

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NOT all congenital clefts of the lip and palate are alike. Cleft lip and cleft palate do not represent a single fixed clinical entity subject to generalizations of description and classification, and least of all to rigid therapeutic formulas. Most classifications that have appeared in the literature are insufficiently descriptive and arbitrarily reflect the clinical interest of a single professional group without providing universal intelligibility. The noted surgeon, Vilray P. Blair, in commenting on a classification of congenital clefts based on the surgical requirements, rather than on the anatomic differences, stated quite succinctly, "The surgery is shifting and the anatomy is fixed."[1]

With the development of multiprofessional teams for the care of children with clefts of the lip and palate, the additional problem of interdisciplinary communication has arisen. This paper was conceived as a means of providing a language of clarity and common intelligibility by which the variety of clefts may be described, classified, and analyzed. To do so, we shall begin with the unoperated defect as it occurs in the infant or in the young child.

METHODS AND MATERIALS

The material presented is derived from a continuing longitudinal growth study of newborn infants with cleft lip and cleft palate under the direction of the Department of Orthodontia and carried out in the Cleft Palate Center of the Chicago Professional Colleges of the University of Illinois. The project derives support from a grant provided by the Children's Bureau of the Federal Security Agency. Now in its fourth consecutive year, this study has accumulated data on more than 350 different individuals. The largest portion of this number is composed of unoperated cases in the newborn patients.

Two methods are employed in this study. One is a roentgenographic technique and the other involves casts of the face and jaws. The data obtained by these methods permit accurate quantification of the growth of the head and of certain of its structures. A cephalometer was designed to meet the special requirements of this investigation (Figs. 1 to 4). This instrument is a modification of that previously described by Ortiz and Brodie.[2] Aside from several minor modifications, this machine incorporated the general principles of the Broadbent-Bolton cephalometer.[3] Recently, cephalometric laminagraphy also has been

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employed in the study of these children in an effort to improve visualization of structures in the frontal plane that are less readily observed in the frontal headplate.[4-6] Alginate impressions of the hard and soft palate and of the upper face in repose are part of the routine records obtained at regular intervals (Fig. 5). These measurements are made possible by sedating the younger children with a barbiturate given in aqueous suspension by rectum.

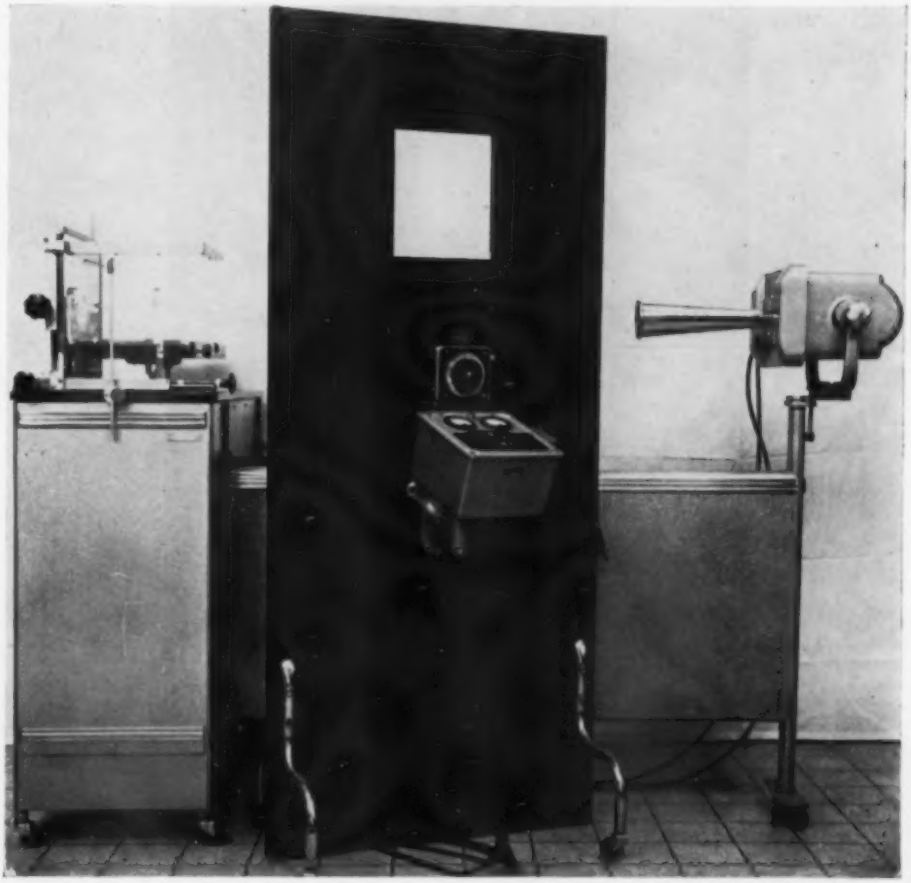

Fig. 1.—Specially designed cephalometer. The x-ray tube for the frontal film is concealed within the cabinet beneath the head holding device.

The patients are recalled for study every three months during the first year of life and twice annually until the age of 5. Thereafter, they are returned on a yearly basis. These records represent the surgical efforts of more than twelve different plastic surgeons. Not all of these surgeons share similar views as to the indications for surgery, the time for surgery, or the kind of surgical technique to be employed. The concerted efforts of the Cleft Palate Center, the Division of Services for Crippled Children, a number of public health agencies, and the various facilities of the Professional Colleges of the University of Illinois represent an efficient and convenient means for collecting and interpreting data that heretofore has been dispersed and inaccessible for group study.

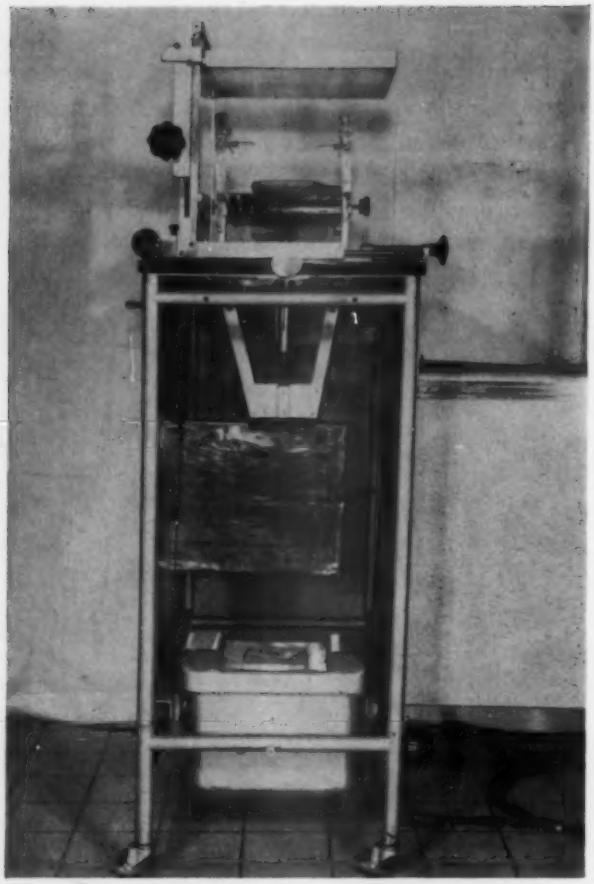

Fig. 2.—The panel covering the cabinet has been removed to expose the x-ray tube pointing upward. The cassette holder for the frontal films may be adjusted in the vertical and horizontal planes of space.

Fig. 3.—Close-up of an infant in the head holding device. The cassette holder for the lateral film may be adjusted in the vertical and horizontal planes of space. The correctional scale is projected onto each lateral film.

THE MOST FREQUENT VARIETIES OF CLEFT LIP AND CLEFT PALATE

In accordance with the elemental facts of the embryology, anatomy, and physiology of the cleft defect, the varieties of clefts of the lip and palate may be tabulated into four general categories: (1) those involving the lip alone, (2) those involving the lip and palate, (2) those in which the palate alone is affected, and (4) congenital insufficiency of the palate. For the sake of simplicity, in the greater part of this discussion, the term "palate" will include both the hard palate and the velum, or soft palate. As will be explained later, no special mention is made of the alveolar process in this classification (Fig. 6).

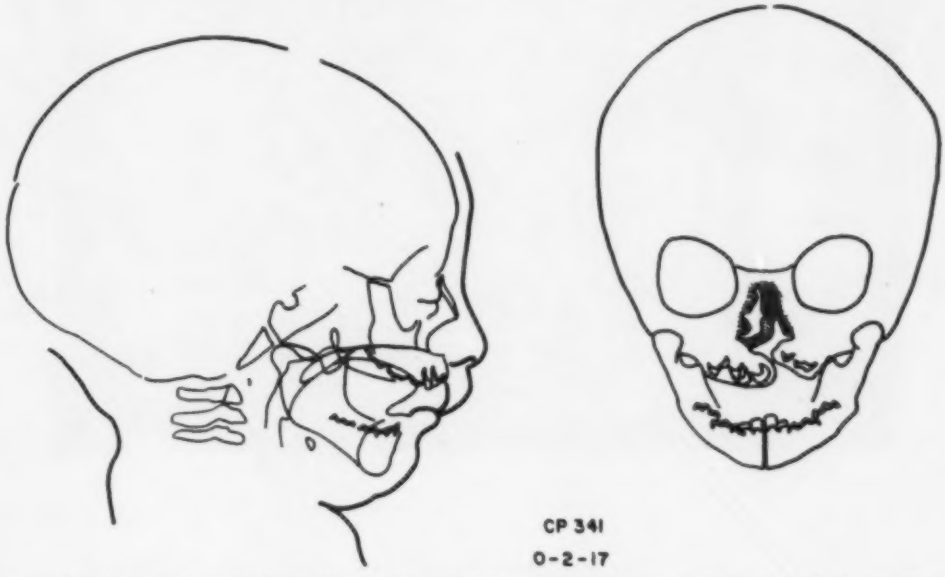

Fig. 4.—Lateral and frontal tracings of headplates obtained on an infant aged 2 months, 17 days with an unoperated, complete cleft of the lip and palate on the left side.

1. *Clefts of the Lip.*—A cleft of the lip may be complete, extending from the vermilion border to the floor of the nose, or it may be incomplete. Various degrees of incompleteness are recognized (Fig. 7). Minimal defects involving only the vermilion border are observed. In others, the defect may extend up to the nose as a submucous cleft in the muscle band, bridged only by mucous membrane, skin, and fibrous connective tissue (Fig. 8). The nasal alar cartilage on the side of the cleft is displaced and flattened to a greater or lesser degree, depending on the extent and width of the cleft. The distinction between a lateral and medial crus in the flattened alar cartilage is not clear. The tip of the nose is deviated toward the noncleft side (Fig. 9).

The cleft in the lip may be unilateral or bilateral. If bilateral, it may be symmetrical or asymmetrical. That is, it may or may not involve the lip equally on both sides. It should be noted that in bilateral clefts, a median portion of the lip is isolated in the midline and remains attached to the premaxilla and to the columella. This portion of the lip contains the philtrum. In complete bilateral clefts of the lip, the premaxilla protrudes considerably forward of the facial profile. It is attached to a stalklike vomer and to the nasal septum. The

columella appears to be deficient, and the alar cartilages are flattened on both sides (Fig. 10). The effect on the facial profile is to accentuate further the protrusiveness of the premaxilla and that portion of the lip which is attached to its facial surface (Fig. 11).

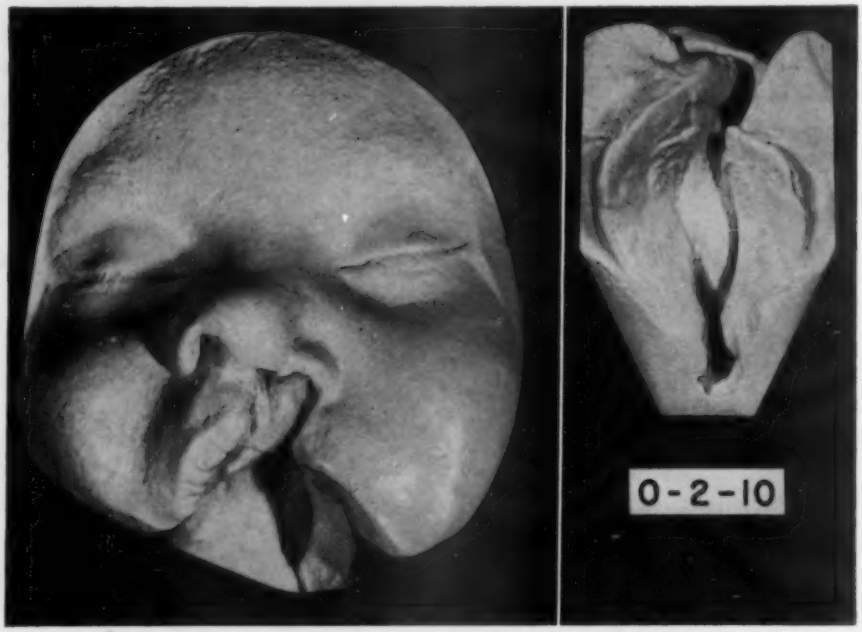

Fig. 5.—Casts of an infant 2 months, 10 days old with an unoperated, complete cleft of the lip and palate on the left side.

By noting the extent to which the lip was involved, it was possible to predict, with considerable accurary, the extent of the defect in the alveolar process on the same side. The more complete the defect in the lip, the greater was the cleft in the alveolar process. Because of this constant relationship between the lip and alveolar process, it was not thought necessary to include the alveolar process as a separate entity in our description and classification. Although a direct relationship between the extent of the defect in the lip and alveolar process was shown to exist, it was not possible to predict from the examination of the lip whether the palate itself was involved. An explanation for these observations may be derived from the fact that the entire palate does not develop from the palatine processes. The maxillary alveolar processes arise from the mesoderm in the depths of a sulcus separating the lip and palate, while the tegmen oris gives rise only to the soft palate and the central part of the hard palate.[7]

Two cases are available in our collection which reveal submucous clefts of the alveolar processes in the absence of a cleft of the lip. In both instances the cleft was bizarre and was coupled with severe multiple anomalies elsewhere in the body. In addition, a few median clefts of the palate have been examined, but altogether these cases are rare and not representative of the general problem to warrant discussion in this report.

The relation between the degree of the cleft in the alveolar process and the defect in the deciduous and permanent dentition is interesting. The dental defect may be assessed in terms of the number of teeth, their shape and structure, as well as the position of the teeth in the dental arch. The irregularities in the alveolar process range from small dimples in association with minor clefts in the lip (Fig. 12) to actual grooves in the alveolar process, and to the extreme

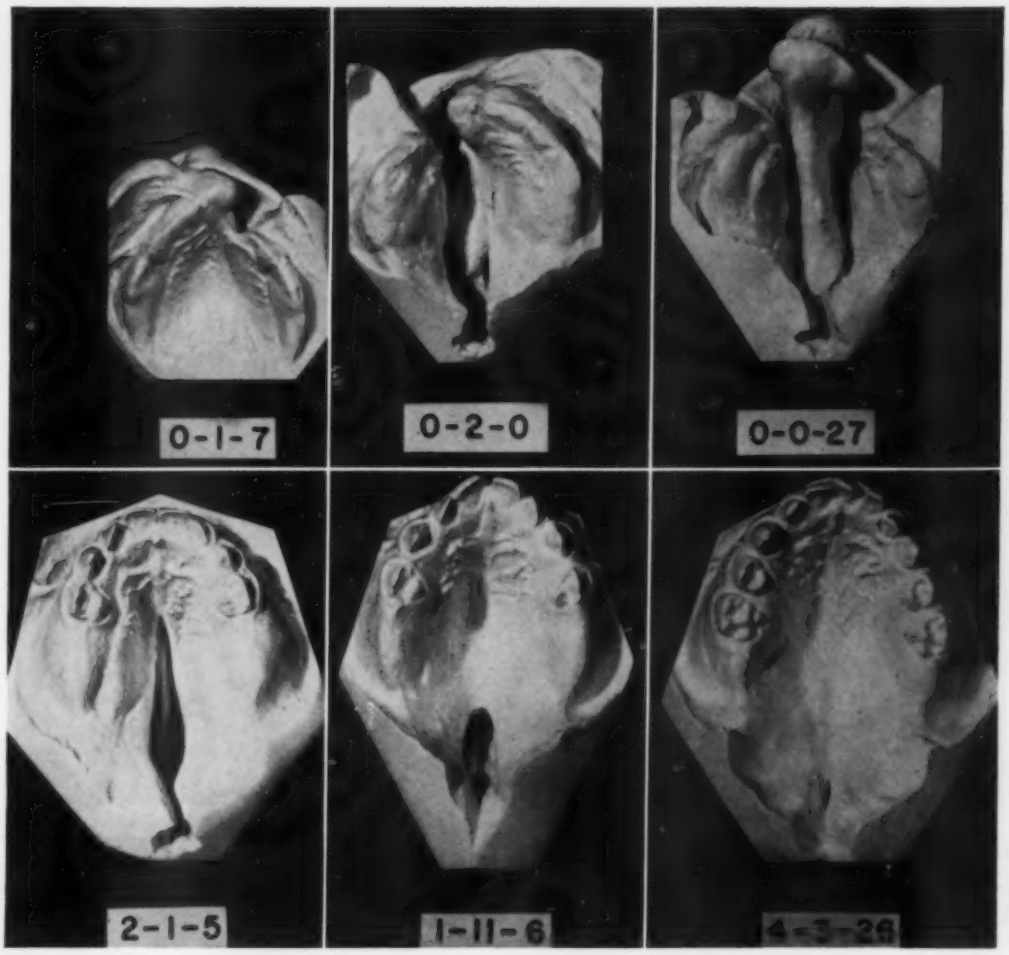

Fig. 6.—Representations of the most common clefts of the lip and palate. All of these casts were obtained in infants and young children *prior to any surgical procedure*. *A*, Complete unilateral cleft of the lip on the left side and involving only the alveolar process. Aged 1 month, 7 days. *B*, Complete unilateral cleft of the lip and palate on the right side. Aged 2 months. *C*, Complete bilateral cleft of the lip and palate. Aged 27 days. *D*, Cleft involving the hard and soft palate and extending as far forward as the nasopalatine foramen. Aged 2 years, 1 month, and 5 days. *E*, Cleft of the soft palate. Aged 1 year, 11 months, and 6 days. *F*, Bifid uvula. Aged 4 years, 3 months, and 26 days.

of total clefts in the alveolar ridge with displacement of the premaxillary segment toward the noncleft side. The small dimples or grooves in the alveolar ridge tend to fill in as the jaw grows. However, the deciduous lateral incisor that erupts in this position may be T-shaped or otherwise misshapen and generally malposed in the line of occlusion (Fig. 13). Further documentation and

analysis of serial records should provide detailed information concerning the eruption of teeth adjacent to the cleft in the alveolar process.

2. *Cleft Lip and Cleft Palate.*—Clefts of the lip and palate may be unilateral or bilateral. They may be complete or incomplete. In a complete unilateral cleft of the lip and palate, a direct communication exists between the oral and nasal cavities on that side of the palate in which the cleft is situated. The nasal septum is attached to the palatal process on the opposite side, thus separating the nasal chamber from the oral cavity (Fig. 4).

Fig. 7.—Casts of the upper lip and nose in infants with several varieties of unoperated unilateral clefts of the lip. The cast at the upper left reveals an incomplete cleft of the lip on the left side that extends as far as the vermilion border. Note the symmetry of the external nares. The cast at the upper right exhibits a more extensive cleft of the lip, together with flattening of the nasal alar cartilage. Each of the remaining casts is that of a complete unilateral cleft. The cast in the middle reveals an overlapping of the labial and alveolar segments. The two casts in the bottom row show varying degrees of separation between the labial segments.

A remarkable range of variation exists in each category (Fig. 14). Some unilateral clefts exhibit wide separation of the palatal shelves. Others are less separated, and in some actual overlap of segments occurs, even prior to surgical closure of the lip. The palatal segment on the side of the cleft is often tilted medially and upward. The vomer is deviated from the midline at the line of attachment to the palatal process on the noncleft side. This deviation may be so extreme that the vomer assumes a nearly horizontal position at its inferior margin. Various degrees of incompleteness of the cleft in the lip and palate may exist in combinations too numerous to describe conveniently.

Fig. 8.—Unoperated incomplete cleft of the lip on the right side. The defect extends into the nose as a submucous cleft in the labial musculature. It is bridged only by mucous membrane, skin, and some fibrous connective tissue. The nasal alar cartilage is flattened on the side of the cleft, and the tip of the nose deviates toward the opposite side.

Fig. 9.—Unoperated complete unilateral cleft of the lip and palate on the right side. The cleft in the lip extends into the floor of the nose. The nasal alar cartilage shows extreme flattening. The tongue is postured within the area of the cleft in the palate.

The bilateral cleft lip and palate also may be complete or incomplete. If incomplete, it may be symmetrical or asymmetrical, depending on the equality of involvement on both sides. In the complete bilateral cleft lip and palate, both nasal chambers are in direct communication with the oral cavity. The palatal processes are divided into two equal parts and the turbinates are clearly visible within both nasal cavities. The nasal septum forms a midline structure that is firmly attached to the base of the skull, but is fairly mobile in front where it supports the premaxilla and the columella. Skeletal specimens[8] and cephalometric roentgenograms reveal the existence of a suture line between the vomer and the premaxilla (Fig. 15). The importance of this suture to facial growth, as well as a point of flexion for the premaxilla upon the vomer, merits further study.

Fig. 10.—Unoperated complete bilateral cleft of the lip. The palate is not involved. The premaxilla, or the intermaxillary segment, projects forward carrying the philtrum and the columella.

The so-called premaxilla, or intermaxillary segment, may be small or large, symmetrical or asymmetrical (Fig. 16). The number of incisor teeth contained in this segment is related directly to its size and shape. Where the cleft of the lip is complete on both sides, the premaxilla projects considerably forward of the facial aspect of the maxillae. This anterior protrusion is less evident if the lip is incompletely cleft on one or both sides.

3. *Cleft Palate.*—In this category, neither the lip nor the alveolar process is involved. The cleft may involve only the soft palate, or the soft and hard palates, but never the hard palate alone (Fig. 17). This observation is in accord with the finding that fusion of the hard and soft palates proceeds from in front backward.[9]

The cleft may extend forward from the uvula to a varying degree. In some, the cleft is limited to the uvula or to the soft palate. In others, it may extend into the hard palate. Digital examination of the hard palate is recommended to reveal the existence of submucous clefts. The full extent of submucous clefts may be mapped by cephalometric laminagraphy.

Fig. 11.—Profile view of an unoperated bilateral cleft of the lip. The projecting premaxilla and the shortened columella is characteristic of these clefts.

In the extreme form, the cleft may extend anteriorly as far as the nasopalatine foramen. Where the cleft involves a considerable portion of the hard palate, the nasal chambers are in direct communication with the oral cavity. In most instances, the nasal septum is not attached to either palatal process throughout the extent of the cleft. However, occasional asymmetries may be noted in which the septum is attached to a portion of the palatal process on one side to a greater extent than to the palatal process on the opposite side.

The outline of the cleft may be wide or narrow, pyriform or V-shaped. Excessively wide dental arches often are associated with wide clefts that extend to a considerable degree into the hard palate. In such instances, the mandibular

Fig. 12.—Unoperated incomplete cleft of the lip on the left side in an infant of 8 months, 23 days. The defect in the lip extends as far as the vermilion border. The alveolar process is slightly "dimpled" in the region of the left lateral incisor.

Fig. 13.—Unoperated incomplete cleft of the lip on the right side in a 13-month-old child. The cleft in the lip extends beyond the vermilion border as a submucous defect in the muscle band. The lateral deciduous incisor on the side of the cleft is malposed and considerably larger than the incisor on the uninvolved side.

dental arch may be in complete lingual relation to the maxillary arch so that the cusps of the teeth do not interdigitate in occlusion. Lateral cephalometric headplates reveal that the dorsum of the tongue, at rest, is elevated and is postured within the nasal cavity. The impression is gained that during deglutition the thrusting action of the tongue operates to separate the palatal processes.

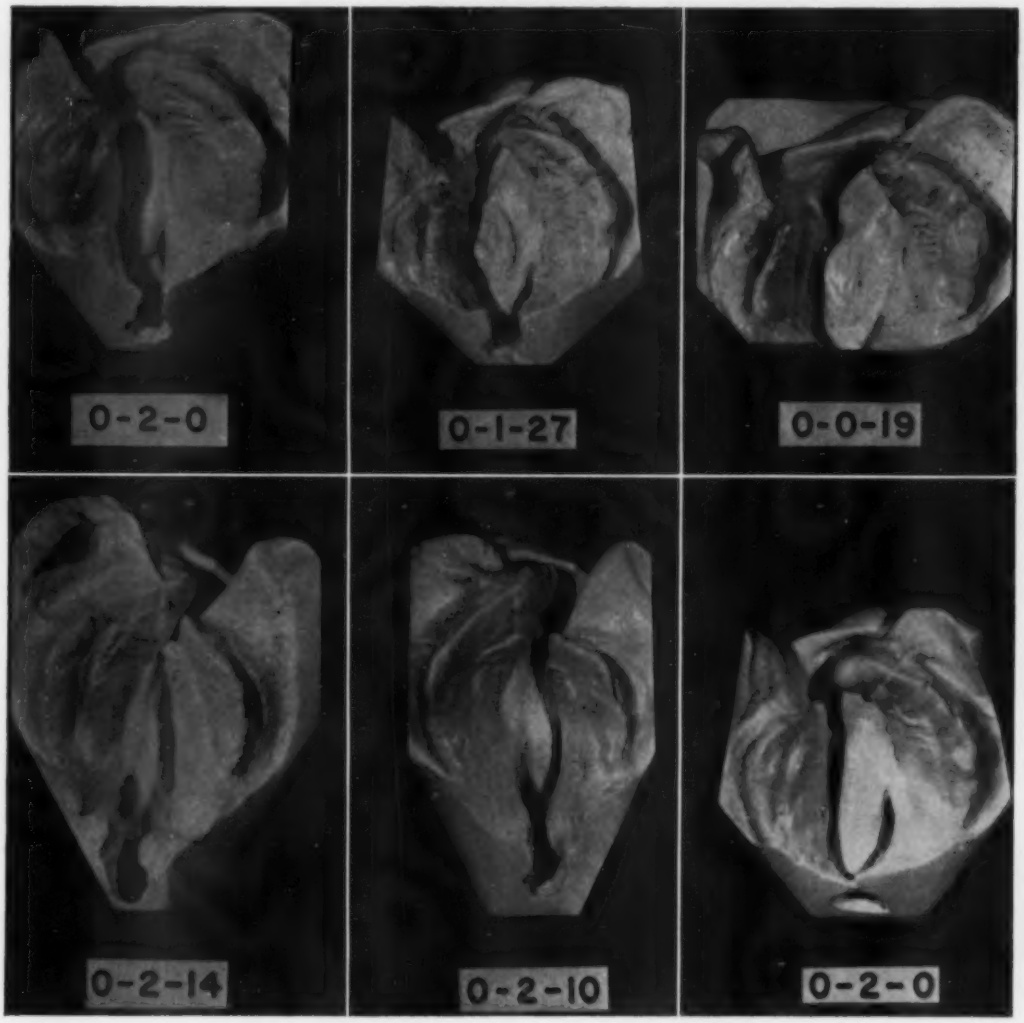

Fig. 14.—Varieties of unoperated complete unilateral clefts of the lip and palate. By classification and general description, each of these clefts is alike. Clinically significant differences are apparent in the width of the cleft and in the spatial relationship of the palatal processes.

These abnormalities in the posture and movements of the tongue are supported by the observations of speech pathologists. In a recent review, the hypothesis was advanced "that at least some of the cleft palate patient's 'nasality' results from his persistent habit of elevating the mandible and the dorsum of the tongue during speech."[10]

In this group of clefts, the vomer is significantly different in its size and form from that observed in the bilateral cleft lip and palate. In both types,

the vomer is visualized as a midline structure extending downward from the base of the skull. However, in the bilateral cleft lip and palate the inferior border of the vomer is thick and rounded, whereas in this category the vomer is thin and knife-edged. Serial observations reveal that the pattern of growth exhibited by the vomer is different in these two types of clefts.

The several distinguishing characteristics apparent in some of the clefts in this category merit further comment. The high incidence of mandibular micrognathia found in patients with cleft palate gives credence to the theory that during embryonic development the tongue did not sink below the palatal processes, and therefore prevented their fusion in the midline. This raises the question as to whether more than one etiological mechanism might exist to produce the varying kinds of clefts of the lip and palate.

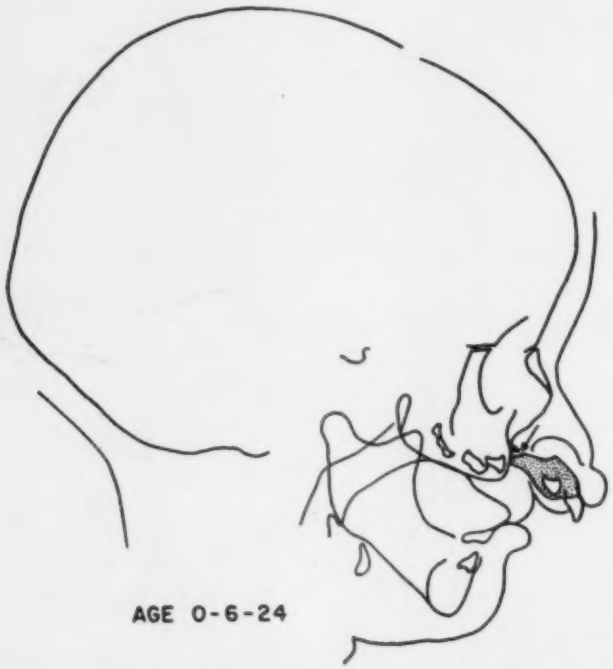

Fig. 15.—Tracing of a lateral headplate of an infant with an unoperated complete bilateral cleft of the lip. Note the premaxillary-vomer suture indicated by the arrow.

In an extensive study of the mode of inheritance of cleft lip and cleft palate, Fogh-Andersen pointed out that there are two different malformations with no genetic connection. In one group are included those clefts that involve the lip, and occur most frequently in male patients. The other group is limited to clefts of the palate, which are more frequent in female patients. According to Fogh-Andersen, the manner of inheritance differs for the two groups.[11]

4. *Congenital Insufficiency of the Palate.*—It has been said that cleft palate is the kind of defect that can be "seen, felt, and heard." The defect included in this category, until recently, has been more readily heard than seen or felt. This anomaly is seldom apparent at birth and the first awareness of the defect

occurs when the child develops the hypernasality characteristic of uncorrected cleft palate speech. The variety of factors producing this kind of speech defect are subject to examination by roentgenographic methods.

During deglutition and during phonation, except for the sounds of *m*, *n* and *ng*, the soft palate elevates, making contact with the posterior and lateral walls of the pharynx. The complicated synergies that contribute to this multidimensional contraction serve to separate the nasopharynx from the oropharynx.

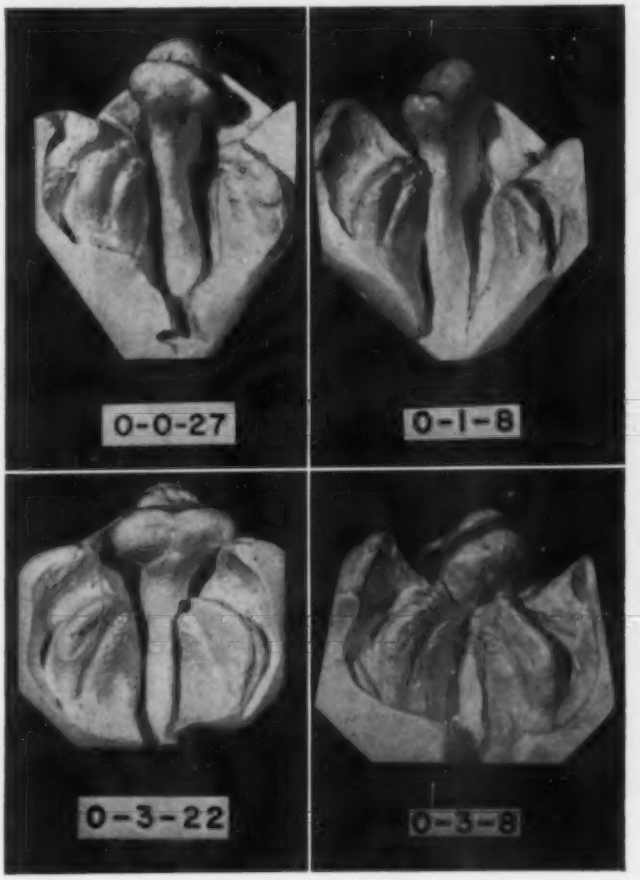

Fig. 16.—Varieties of unoperated complete bilateral clefts of the lip and palate. Note variation in size, shape, and position of the premaxilla.

This mechanism of velopharyngeal closure can be studied by cephalometric roentgenography. The vowel *u*, as in "boom," is generally employed to achieve maximal elevation of the soft palate during vowel production. After careful rehearsal, the subject is instructed to maintain the sound at a constant pitch and intensity for a time sufficient to cover the exposure period. If a three-second exposure is required, the sound is held for at least five seconds so that the middle three seconds of effort are registered on the film. This procedure insures reasonable stability of position of the soft palate during the recorded interval. In the normal individual, as visualized in the lateral headplate, the soft palate elevates to contact the posterior pharyngeal wall. In doing so, the

longitudinal axis of the soft palate becomes continuous with that of the total palatal plane, while the uvula projects downward and nearly at right angles to the rest of the velum (Fig. 18). If for any reason this velopharyngeal closure cannot be achieved, deglutition is impaired, and in phonation the air stream is misdirected through the nose (Figs. 19, 20, and 21).

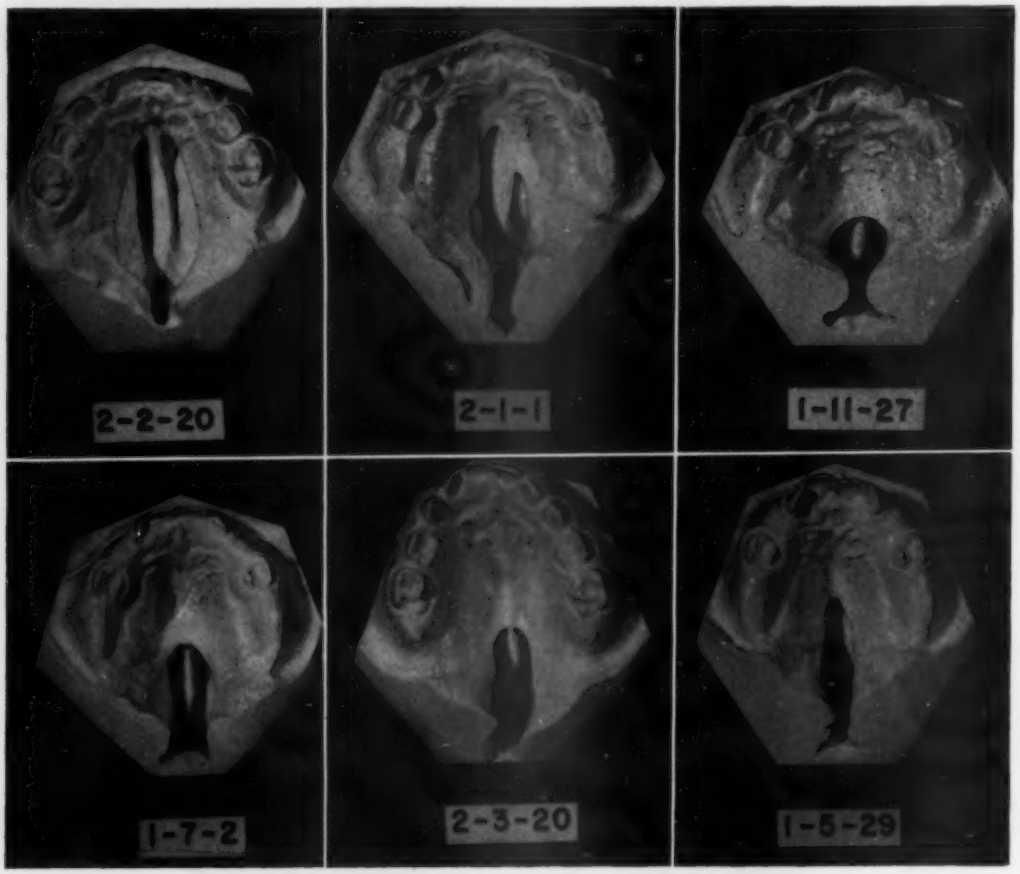

Fig. 17.—Varieties of unoperated cleft palate. The cleft may extend, in varying degrees, as far forward as the nasopalatine foramen. In its lateral dimensions, the cleft may be wide or narrow, V-shaped, or pear-shaped.

The term "palatal insufficiency" is more descriptive of a physiologic deficiency than of the anatomic defect. In reviewing the morphologic variants that might contribute to inadequate velopharyngeal function, Dorrance[12] recognized a number of factors. He pointed out that the velum might be too short or that the hard palate could be deficient in its anterior-posterior dimension. In others, both the hard and soft palates might be shorter than normal. Submucous clefts in the median line of the palatal processes, in the palatal aponeurosis, and in the muscles of the velum are often described in cases with congenital palatal insufficiency (Figs. 20 and 22).

As we shall point out later, our own concept of the defect in congenital palatal insufficiency has been extended to include a broader view of the pharynx and its contiguous structures.

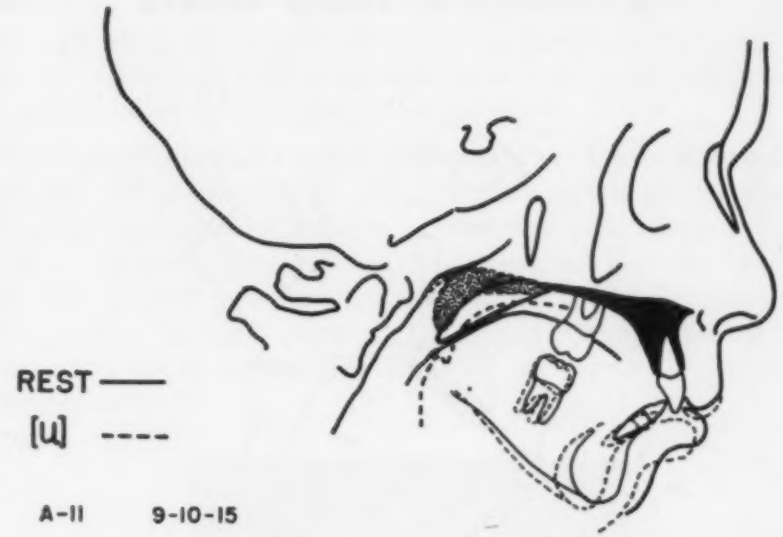

Fig. 18.—The posture of the tongue and velum in relation to the posterior pharyngeal wall is illustrated at rest and during the phonation of u as in "boom." The convex projection in the epipharynx marks the presence of an adenoid mass.

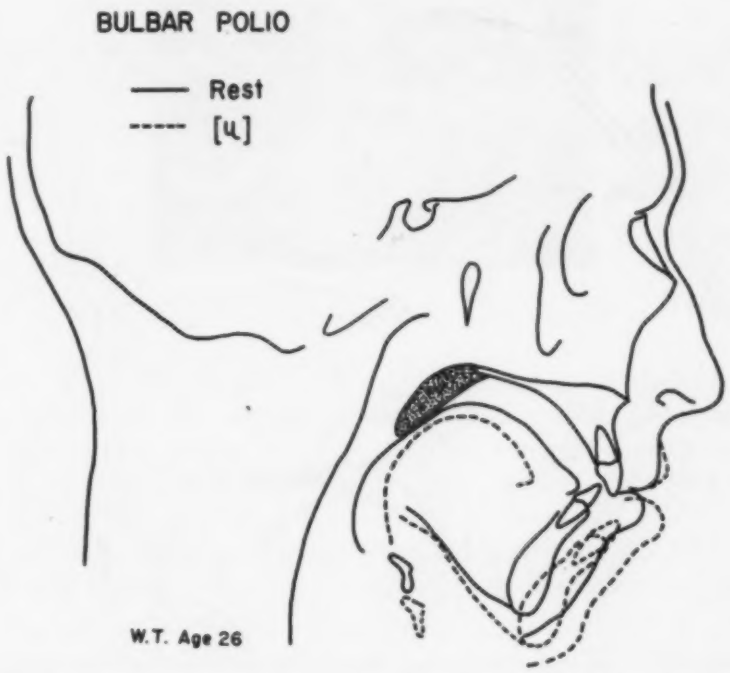

Fig. 19.—Cleft palate speech in an adult as an aftermath of bulbar poliomyelitis. During phonation the tongue elevates but the velum remains motionless, allowing for escape of the air stream through the nasal chambers.

Fig. 20.—Cleft palate speech in an unoperated young adult with congenital palatal insufficiency. Note the contour of the palatal processes, the shortness of the soft palate, and the inability to contact the posterior pharyngeal wall during the phonation of *u*.

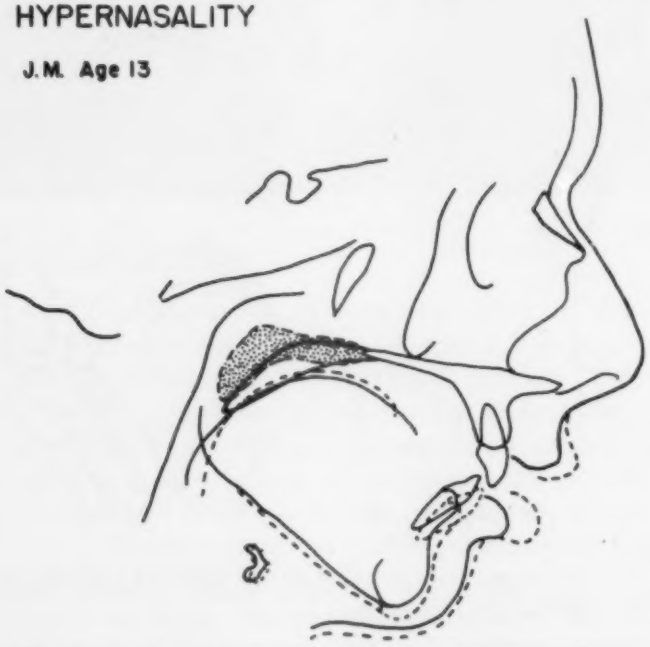

Fig. 21.—Cleft palate speech in a noncleft patient. Multiple adenoidectomies produced a concave deficiency in the posterior pharyngeal wall. Despite the apparently adequate length of the soft palate and its range of motion, velopharyngeal valving is incomplete. Compare with Fig. 18.

ANALYSIS OF THE DEFECT

In evaluating the records of each child from birth onward, certain qualitative criteria are employed in the analysis of the nose, lips, teeth, jaws, tongue, and pharynx. Quantitative methods also have been developed to permit accurate measurement of the variables under discussion.

A. *Adequacy of Parts.*—The first thought that occurs when one sees a cleft in a newborn child is whether or not something is missing. Does the cleft represent a nonunion of parts that are intrinsically adequate or are the parts, per se, inadequate or even in excess? If the individual parts are inadequate in themselves, any attempt to bring these parts into direct apposition by surgical means will produce an inadequate total structure. Supra-adequacy is sometimes apparent in the alveolar process and may be reflected by the presence of supranumerary teeth.

Fig. 22.—Maxillary cast of case illustrated in Fig. 20. The shadows in the palatal vault reflect the ridgelike distortions in the palatal processes.

B. *Distortion of Parts.*—Aside from the problem of intrinsic adequacy of the anatomic parts, are the segments in any way distorted? Muscle tissue develops and begins to contract in utero prior to the calcification of the hard structures. It is conceivable that the perverted pull of a divided orbicularis oris or soft palate may deform the bony and cartilaginous structures during their active formative periods. The flattened alar cartilage, devoid of a distinct medial and lateral crus, serves as an example of such deformation of an anatomic part.

C. *The Spatial Relationship of the Anatomic Segments.*—The aberrant vectors of muscle pull and possibly the misplaced insertions of muscle fibers may act to modify the geometric relationship of parts (Fig. 23). In addition, the action of the tongue, buccinator, palatal, and pharyngeal muscles on the unbuttressed bony segments can contribute to their spatial derangement. To

illustrate, the maxillary arch in a unilateral cleft of the palate may be asymmetrical in outline and narrow in its transverse diameter. The palatal process on the side of the cleft is observed to be inclined medially and superiorly. This spatial configuration of parts not only reduces the effective width of the total palate but, since the roof of the palate is also the floor of the nose, serves to narrow the nasal chamber and restrict ventilation on that side (Fig. 4). Thus, a decrease in the width of the maxillary arch is not necessarily due to a deficiency in the size of the palatal processes, but rather to their spatial interrelation.

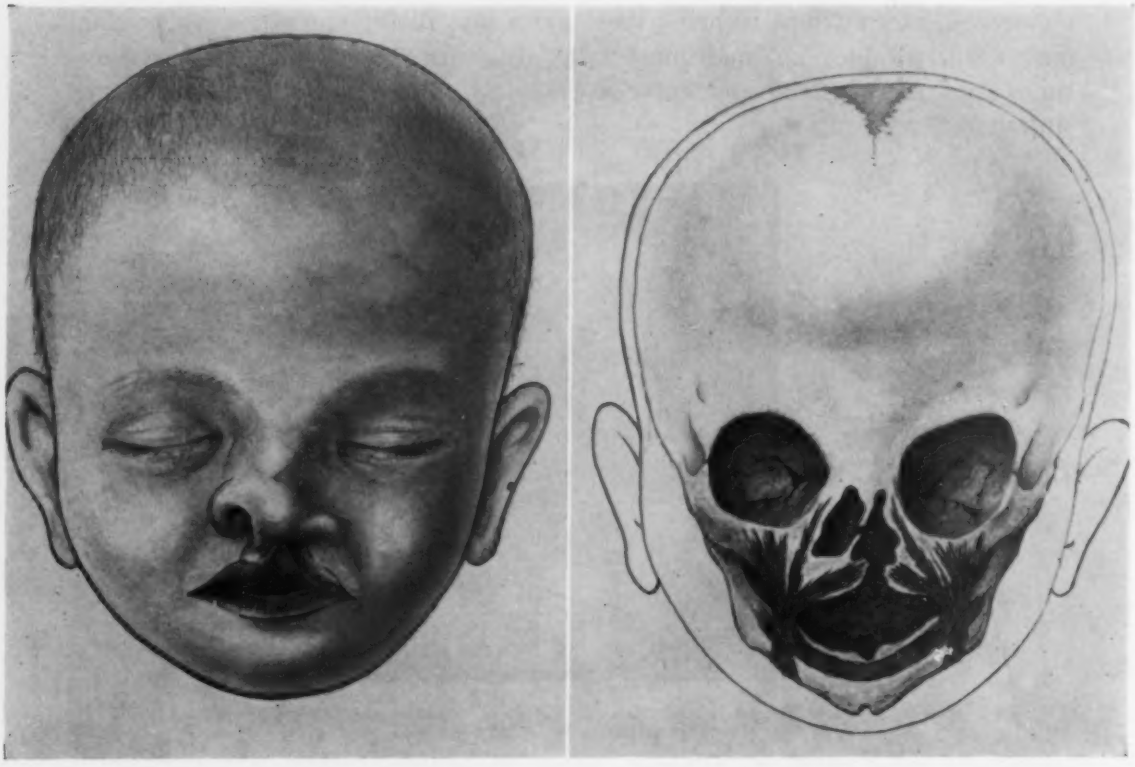

Fig. 23.—Semidiagrammatic visualization of the arrangement of the facial musculature in an unoperated complete unilateral cleft of the lip and palate.

D. *What Is the Relationship of the Palate to Contiguous Anatomic Structures?*—The individual ability to compensate for a localized anomaly depends not only upon the severity of the defect itself, but also upon anatomic and functional variations in adjoining structures. If the child with a cleft palate is also endowed with a prognathic mandible, the ultimate deviation in the facial profile will be emphasized by the integrated effect of variation in several areas of the face. The importance of the postural relations of the tongue and mandible to the soft palate in the pathophysiology of cleft palate speech has been reviewed elsewhere.[10]

The lateral x-ray film has provided useful information regarding the anteroposterior and vertical dimensions of the pharynx. McCarthy,[13] employing

such films, demonstrated the stenosis of the nasopharyngeal space due to a protruding arch of the atlas. Schüller[14] published x-ray films and tracings of these films to illustrate extreme variations in the contour of the bony structures outlining the pharynx. He found that variations in the angulation of the cranial base, in the posterior cranial fossa, and in the atlas, served to modify the dimensions of the pharyngeal space. Similar studies by Ricketts,[15] in which he employed midsagittal cephalometric laminagraphy, suggested that the configuration of the cranial base and its relation to adjacent structures were important determinants for successful velopharyngeal function in patients with cleft palate.

The lateral dimensions of the pharynx are not readily visualized by conventional roentgenographic techniques. On the basis of limited skeletal material, Kirkham,[16] Wardill,[17] and Psaume[18] concluded that the lateral dimensions of the pharynx were wider in individuals with cleft palate. The pterygoid plates and the hamular processes were employed as bony landmarks for the assessment of the width of the pharynx. More recently, Subtelny[6] analyzed the lateral dimensions of the nasopharynx as revealed in frontal cephalometric laminagrams. His studies on a large series of normal and unoperated cleft palate children corroborated the conclusions of previous workers and added to our knowledge of the configuration of the pharyngeal spaces.

It has been known for some time that the removal of the adenoids and tonsils can aggravate the speech defect in children with cleft palates. In correlating the findings in the lateral headplates with the speech analysis, the importance of the adenoid mass and its surrounding tissue to velopharyngeal function became apparent. By the position of this tissue on the posterior wall of the pharynx and through its adjacency to the soft palate, velopharyngeal valving can be greatly facilitated. When this tissue is removed, the soft palate must now span a greater distance during its elevation in order to contact the posterior pharyngeal wall. The lateral cephalometric headplate may reveal that, prior to the adenoidectomy, the posterior pharyngeal wall presented a projecting convexity which minimized the required range of motion for the soft palate. Following adenoidectomy, this convexity is no longer evident and instead there may even exist a concave depression in the pharyngeal wall (Fig. 21). To the normal child this may be of no great consequence. But to the child with a soft palate deficient in length or in range of motion, indiscriminate adenoidectomy is an added insult.

E. *The Fourth Dimension of Time.*—Structure and function, as analyzed previously, are not static. They exist not only in a frame of three-dimensional space, but also in a pattern of time. This fourth dimension of time involves the modifications induced by the processes of growth and development as determinants of the ultimate nature of the congenital defect. To understand a behavioral system of time-space relationships as they affect the individual cleft palate patient requires longitudinal study of each patient under observation by means of casts, photographs, and cephalometric roentgenograms.

The analysis described represents a synthesis of ideas from several sources. In essence it should sound familiar to the orthodontic profession, for are not all of our analyses, cephalometric and otherwise, studies in time-space relationships?

DISCUSSION

Uniformity is essential to the development of a common and understandable language for describing all forms and degrees of cleft lip and palate and to the accumulation of statistical data. Keeping within the limits of a single article of moderate length, an attempt was made to describe the general varieties of congenital clefts of the lip and palate. For the sake of brevity, many variations alluded to in this paper were not presented. Because of the multiplicity of variables, no simple verbal description or classification could possibly satisfy everyone concerned with this problem. Moreover, only the interested few can become sufficiently conversant with the pathologic anatomy of the cleft defect to describe what they see in a clear and consistent manner. For those few, the descriptive language employed in this article may be valuable, but for the larger group in the health services who encounter the cleft palate problem on rare occasions, simpler visual aids are a necessity. The easiest way for the intern or public health nurse to describe the defect is to draw a circle around a picture on a mimeographed form. The form employed in our clinic is a modification of that described by Davis and Ritchie.[19]

The question is often raised as to when should the orthodontist's, speech pathologist's, or prosthodontist's interest in the cleft palate child begin. From the experiences gained over the past four years by a large multiprofessional group, the answer is quite clear. Everyone who seeks to serve the needs of the child with a cleft should begin at the beginning. An interest in all the events affecting these children is essential to the training and educational experience that each member of the team must obtain. Each specialist emerges not only better informed in his own field, but with an increased perspective regarding the means available for providing an integrated program of care for the handicapped child.

Intelligent diagnosis and treatment planning in all specialties should be based on a synthesis of the morphologic and physiologic factors observed in each individual case. Records derived from cephalometric roentgenograms and casts of the face and palate afford a quantitatively accurate means for recording the spectrum of individual variations and for plotting the progress of each child in terms of his growth and response to various therapeutic procedures.

SUMMARY

The need for an anatomically accurate means for describing clefts of the lip and palate in the newborn child was stressed. On the basis of photographs, casts of the face and palate, and cephalometric roentgenograms obtained on a large series of newborn babies with clefts, a classification and analysis of clefts of the lip and palate were presented. In all instances, the records were those of patients on whom no surgical procedure had been performed.

Longitudinal growth studies of the individual child with a cleft provide useful information in planning an integrated program of long range care. Such records also serve to contribute to the educative processes of all the specialties represented in the cleft palate team and to establish a means for interprofessional communication.

REFERENCES

1. Blair, V. P.: Discussion of Davis, J. S., and Ritchie, H. P.: Classification of Congenital Clefts of the Lip and Palate, J. A. M. A. **79**: 1323-1327, 1922; p. 1326.
2. Ortiz, M. H., and Brodie, A. G.: On the Growth of the Human Head from Birth to the Third Month of Life, Anat. Rec. **103**: 311-334, 1949.
3. Broadbent, B. H.: A New X-ray Technique and Its Applications to Orthodontia, Angle Orthodontist **1**: 35-66, 1931.
4. Brader, A. C.: The Application of the Principles of Cephalometric Laminagraphy to Studies of the Frontal Planes of the Human Head, Am. J. Orthodontics **35**: 249-268, 1949.
5. Ricketts, R. M.: Unpublished data.
6. Subtelny, J. D.: Width of the Nasopharynx and Related Anatomical Structures in Normal and Unoperated Cleft Palate Children, Master of Science Thesis, University of Illinois, 1953.
7. Sicher, H.: Chapter on the Development of the Face and Oral Cavity in B. Orban, Oral Histology and Embryology, ed. 2, St. Louis, 1949, The C. V. Mosby Company.
8. Veau, V., and Borel, S.: Division Palatine, Paris, 1931, Masson & Cie.
9. Arey, L. B.: Developmental Anatomy, ed. 5, Philadelphia, 1946, W. B. Saunders Company.
10. McDonald, E. T., and Baker, H. K.: Cleft Palate Speech: An Integration of Research and Clinical Observation, J. Speech & Hear. Disorders **16**: 9-20, 1951.
11. Fogh-Andersen, P.: Inheritance of Harelip and Cleft Palate, Copenhagen, 1942, Nyt Nordisk Forlag—Arnold Busck.
12. Dorrance, G. M.: The Operative Story of Cleft Palate, Philadelphia, 1933, W. B. Saunders Company.
13. McCarthy, M. F.: Preliminary Report of Studies on the Nasopharynx, Ann. Otol., Rhin. & Laryng. **34**: 801-813, 1925.
14. Schüller, A.: X-Ray Examination of Deformities of the Nasopharynx, Ann. Otol., Rhin. & Laryng. **38**: 108-129, 1929.
15. Ricketts, R. M.: The Significance of Variation in the Cranial Base and Soft Structures, Newsletter, Am. Assoc. Cleft Palate Rehab. **3**: 5-6, 1952 (abstract).
16. Kirkham, H. L. D.: Quoted by Peyton, W. T.: The Dimensions and Growth of the Palate in the Normal Infant and in the Infant with Gross Maldevelopment of the Upper Lip and Palate, Arch. Surg. **22**: 704-737, 1931.
17. Wardill, W. E. M.: Cleft Palate, Brit. J. Surg. **16**: 127-148, 1928.
18. Psaume, J.: Contribution a l'Etude du Squelette du Bec de Lievre et de la Division Palatine Non-Operes, These Doctorat en Medecine, Paris, 1950.
19. Davis, J. S., and Ritchie, H. P.: Classification of Congenital Clefts of the Lip and Palate, J. A. M. A. **79**: 1323-1327, 1922.

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INTEGRATION OF ANATOMIC AND CEPHALOMETRIC STUDIES OF GROWTH OF THE HEAD

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RECENTLY we[1] described a course in development of the head, for freshmen dental students: "Each student has several sections of each fetal head so as to obtain a picture of different space levels in a given plane of section. Horizontal, frontal and sagittal sections of fetal heads at different age levels are also studied, thus giving the student a composite mental picture of the normally growing head as a space-time structure."

It was the use of such material for graduate students in orthodontics that caused conflict, that is to say, conflict between the Broadbent conception[2] of the development of the head, and what was conceived by some anatomists from histological sections of fetal material[3] and animal experiments.[4] This paper is an attempt at reconciliation of the conflict.

The central idea of the Broadbent school is that development of the head of the same individual can be studied by taking x-rays at various intervals from birth to the adult stage. A relatively fixed plane—the cranial base—is used for superimposing these x-ray pictures or cephalograms. "In a chart of normal developmental growth of the face—Figure 1—there are registered in Bolton relation, the profile outlines of individuals representative of the Bolton groups at the ages shown. . . . Tracing the direction and amount of change in the various areas included in the chart, we find those landmarks in the median sagittal plane moving in a straight line forward and downward with the exception of nasion *Na*—that is above the fixed point *R*. This moves forward and slightly upward. The anterior end of the palate, the incisor teeth and gnathion *GN* move downward and forward to a greater or lesser degree depending upon their proximity to the cranial base."[2]

Fig. 2 is a lateral view of the disarticulated bones of the skull at birth. The individual bones are spread apart in space to indicate the problem of differential skull growth from birth to the adult stage, i.e., how the individual bones change in relative proportions as they increase in size. Note the central position of the sphenoid bone at the base of the cranium.

Diamond[3] did not believe that there is a fixed cranial base in the growth of the skull, or that the pterygoid buttress of the sphenoid bone "shoves the expanding maxilla forward." He wrote that "to understand the manner and direction of growth of the jaw bones it is important to visualize growth of the bone in three dimensions. The bone grows simultaneously in all directions. By so visualizing one can more easily understand what happens at a suture. As growth of [maxillary] bone occurs labially, the perimeter of the anterior curve is steadily increased, widening the suture area into which bone grows from

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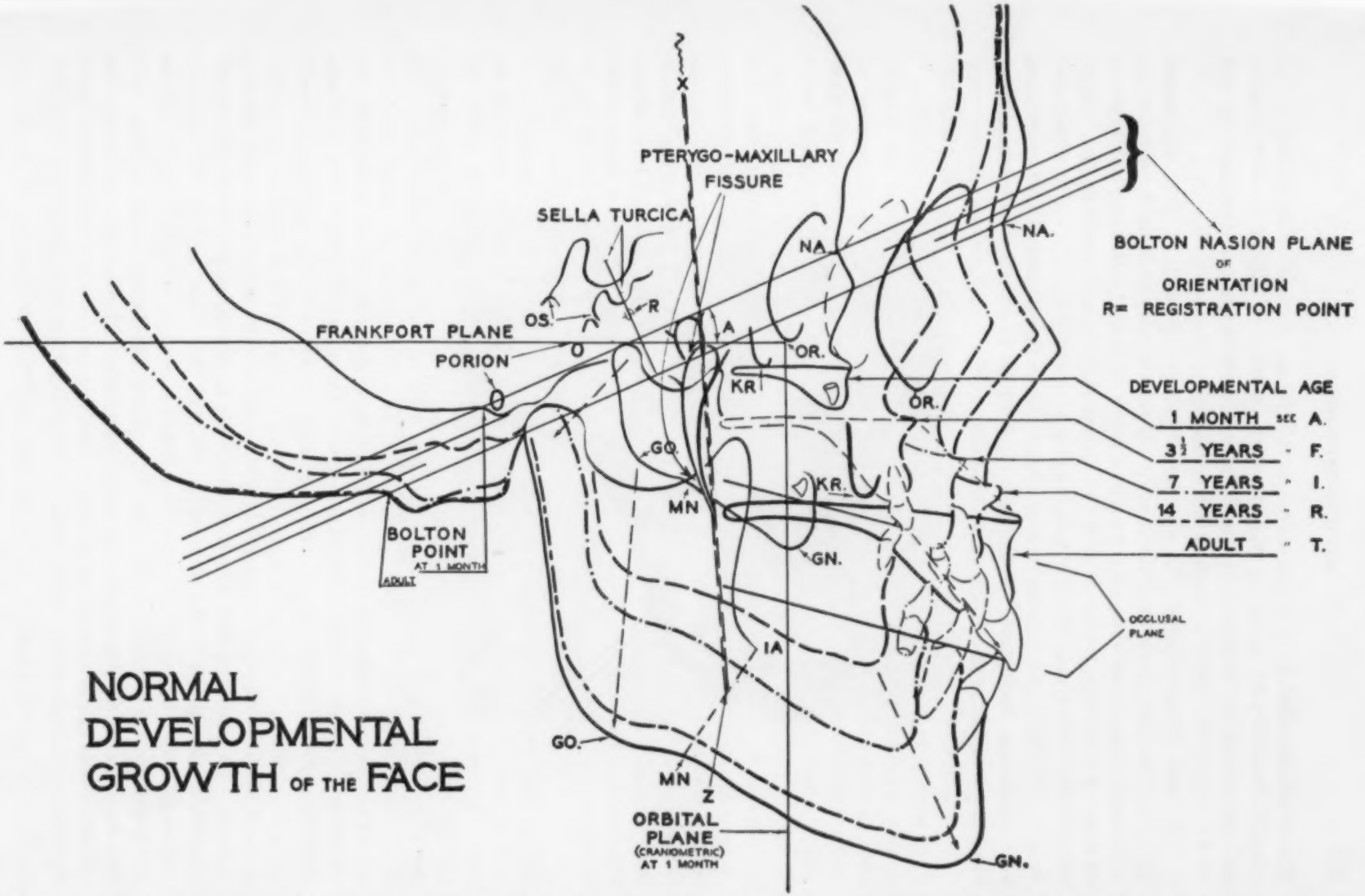

Fig. 1.—Chart of normal dentofacial growth from the Bolton Study records. *GN*, Gnathion; *GO*, gonion; *IA*, internal angle of the mandible; *KR*, key ridge; *MN*, mandibular notch; *NA*, nasion; *OR*, orbitale; *OS*, occipitosphenoidal suture.

the mesial terminal ends of the bone. . . . Therefore there is no spreading of the maxillae laterally by addition of bone at the suture." This was demonstrated in human fetal sections such as Fig. 5, which includes the maxillary suture, and in Fig. 6, which includes the maxillozygomatic suture.

Noback[5] demonstrated that in the embryonic period of man the rapid growth of the membranous skull bones is characterized primarily by a radiation of delicate trabeculae of bone from ossification centers, to form a thin network of bone. In the fetal period of man, the human skull bones become approximated, and continued increase in their size is brought about by surface deposition and internal resorption of bone as well as by growth at the sutures. This conception of "modelling absorption" as the means by which bones retain their shapes as they grow in size was originated by John Hunter.[4]

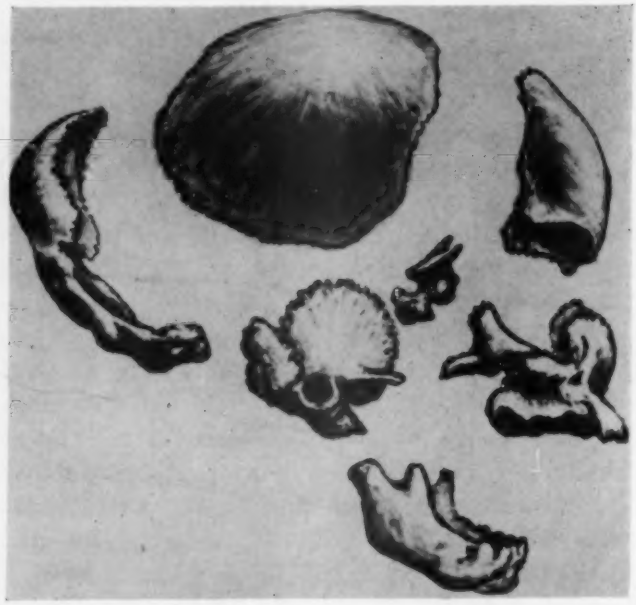

Fig. 2.—Lateral view of the disarticulated bones of the skull at birth. The individual bones are spread apart in space to indicate the problem of skull growth from birth to adult size. Note the central position of the sphenoid bone.

Thus there is histologic evidence that bone growth in the fetal period of man occurs by surface deposition and internal resorption rather than by "separating growth" at the sutures. This is in agreement with the findings of Brash[4] who demonstrated this in his experiments with pigs. Brash showed the actual growth sites of the pig's mandible by experimental madder feeding during growth. He observed that the main increase in the height of the body of the mandible takes place at the alveolar and not at the lower border. He also obtained evidence of how the deposition of bone extends the posterior border of the mandible backward and the condyle upward and backward. Yet this work can be oriented in Broadbent's growth chart, assuming that as increase in the length of the ramus occurs by upward growth in relation to the relatively fixed mandibular fossae of the temporal bones, the mandible is steadily lowered as the resultant of relative growth forces—a sort of vector analysis.

Other anatomists have secured evidence which is in harmony with Broadbent's thesis. Massler and Schour[6] found that growth of the cranial vault of the rat occurs primarily by deposition of bone at the sutures. They showed that there is a period of generalized growth from birth to sixty days with active deposition of bone on all surfaces. Then there is a second period after seventy days where deposition occurs only at certain sites. Moore[7] showed that there are characteristic differences in the pattern of bone growth in the monkey and the pig, especially in craniofacial relations. He also found that the sutures were primary agents in skull growth of the monkey. Weinmann and Sicher[8] called attention to the "parallel arrangement of three important sutural sites of human maxillary growth, namely the fronto-maxillary, zygomatico-maxillary, and pterygo-palatine sutures." They claim that "growth in these sutures will have the effect of shifting the maxillary complex downward and anteriorly."

Perhaps the conflicting schools of thought about the mode of human skull growth are due to the fact that they are based on findings in different species or findings secured at different periods of development of the same species. We shall attempt to show in this paper that histologic evidence from human prenatal material can be oriented in, and reconciled with, the Broadbent frame of reference.

Now the early (embryonic) growth of the skull may seem to be only of academic interest in this connection. But Huxley[9] pointed out that "the parts of the skull like those of the animal framework are developed in succession; the *base* of the skull is formed before its *sides* and *roof;* it is converted into cartilage earlier and more completely than the sides and roof, and the cartilaginous base ossifies and becomes soldered into one piece long before the roof. I conceive then, that the base of the skull may be demonstrated developmentally to be its relatively fixed part, the roof and sides being relatively movable."

In these early prenatal stages, the human cranium grows very rapidly due to the enormous expansion of the brain, and the face grows relatively slowly, that is to say, there is a primary brain expansion and a secondary face and tooth expansion. Fig. 3 is a low-power (× 10) photomicrograph of a median sagittal section of a 24 mm. human embryo oriented in the Bolton plane, *B-N*. We can see the precocious neurocranial development as opposed to the modest facial development. (*O* is the cerebral hemisphere; *C*, the cerebellum; *V*, the fourth ventricle; *S*, the sella turcica; *X*, the nasal septum; *E*, the dental lamina; *M*, Meckel's cartilage; *A*, vertebral cartilage.) This figure should be compared with Fig. 1 where the facial growth is greater than the cranial.

We also see in Fig. 3 that the cartilaginous base of the carnium is in close relation with the cephalic part of the developing vertebral column (*A*). Anteroposterior enlargement of the cartilaginous cranial base occurs by growth at the sphenoethmoid and sphenooccipital cartilaginous sutures or synchondroses. The cartilaginous nasal septum (*X*) extends down from the cranial base, i.e., the ethmoid and sphenoid cartilages in the median line. This septum is the center of vertical development of the face which is expanding downward in relation to the plane of the cartilaginous base of the cranium, although not as rapidly as the cranium is expanding upward.

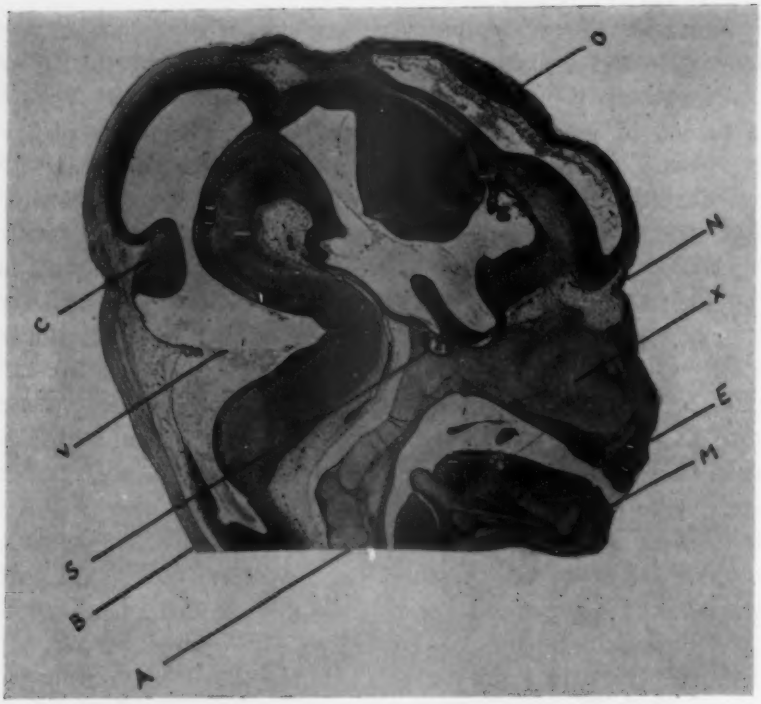

Fig. 3.—Low-power (×10) photomicrograph of a median sagittal section of a 24 mm. human embryo. Note the precocious neurocranial development as opposed to the modest facial development. *B-n*, Bolton-nasion plane of orientation (compare Fig. 1). *X*, The cartilaginous nasal septum extends down from the ethmoid and sphenoid cartilages in the median line; *E*, dental lamina; *M*, Meckel's cartilage; *O*, cerebral hemisphere; *C*, cerebellum; *V*, fourth ventricle; *S*, sella turcica; *A*, vertebral column.

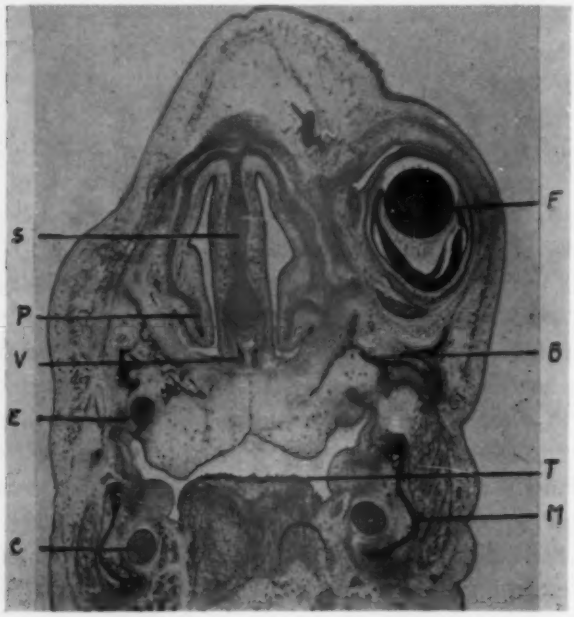

Fig. 4.—Low-power (×10) photomicrograph of a frontal section of a 48 mm. human embryo. *S*, Cartilaginous nasal septum; *P*, cartilaginous turbinate; *V*, developing vomer; *E*, enamel organ; *C*, Meckel's cartilage; *M*, developing mandible; *T*, tongue; *B*, developing maxilla; *F*, eye.

In Fig. 4 we see a low-power (×10) photomicrograph of a frontal section of the head of a 48 mm. human embryo. The palatal processes have united in the median line and the septum of the nose has grown down to unite with them there. Deposition of cartilage in the condyle and ramus has lowered the mandible and the tongue in relation to the relatively fixed plane of the glenoid fossae of the temporal bones.[10]

Fig. 5 is a low-power (×5) view of a frontal section of a human fetus through the maxillary deciduous central incisors (*I*) and the cartilaginous nasal septum (*C*). The developing incisor (*I*) is surrounded by a connective tissue follicle (*F*). Developing bone trabeculae are present all around the tooth follicle except on the incisal. The maxillary suture (*S*) is an active site of bone formation, as the growth of the maxillae occurs labially by surface apposition and internal resorption.

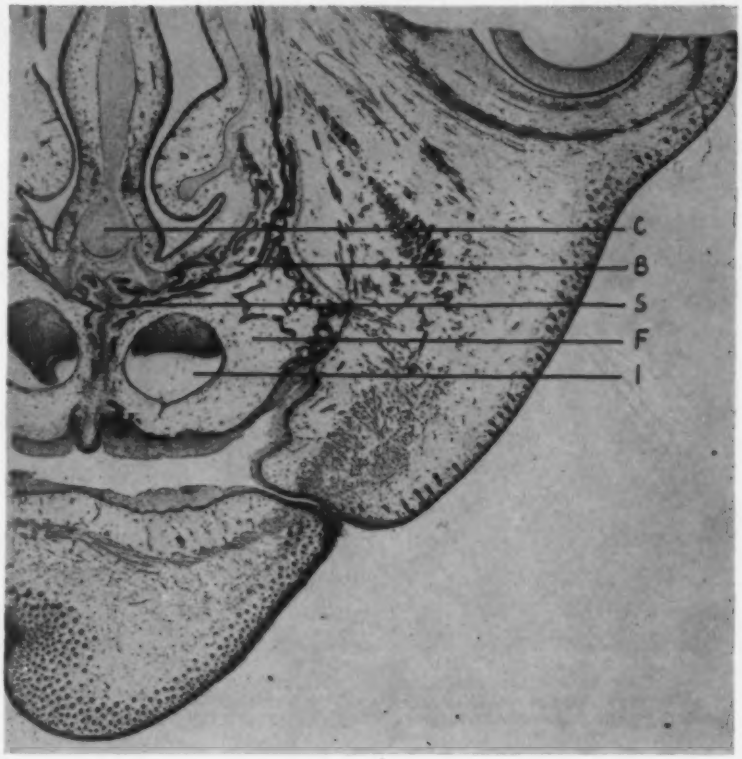

Fig. 5.—Low-power (×5) photomicrograph of part of head of 125 mm. human fetus cut in anterior frontal plane (4½ months). *C*, Cartilaginous nasal septum; *B*, bone of developing maxilla; *S*, maxillary suture; *F*, connective tissue tooth follicle; *I*, enamel organ of central incisor.

While there is resorption of the bone at *B* on the side toward the expanding tooth follicle (*F*), there is also deposition of bone at *B* on the side toward the floor of the nose (Fig. 5). This section has been interpreted[3] to indicate that there is an *upward growth of bone at the floor of the fetal nose.* This seems to conflict with cephalometric studies which indicate that the floor of the nose is moving downward and forward during growth.

Fig. 6 is another section of the same fetal head cut in the plane of the deciduous molar (*M*). In this section we see the cartilaginous nasal septum (*C*) in relation to the vomer (*V*) and the suture of the hard palate (*P*). The vomer at this fetal period (four and one-half months) consists of two laminae of bone separated by a considerable interval and enclosing between them the vomerine cartilage (*C*) which is part of the nasal septum. The continued vertical growth of the nasal septum (*C*) in conjunction with the deposition of bone on the developing vomer (*V*) indicates a downward movement of the palate in relation to the cranial base.

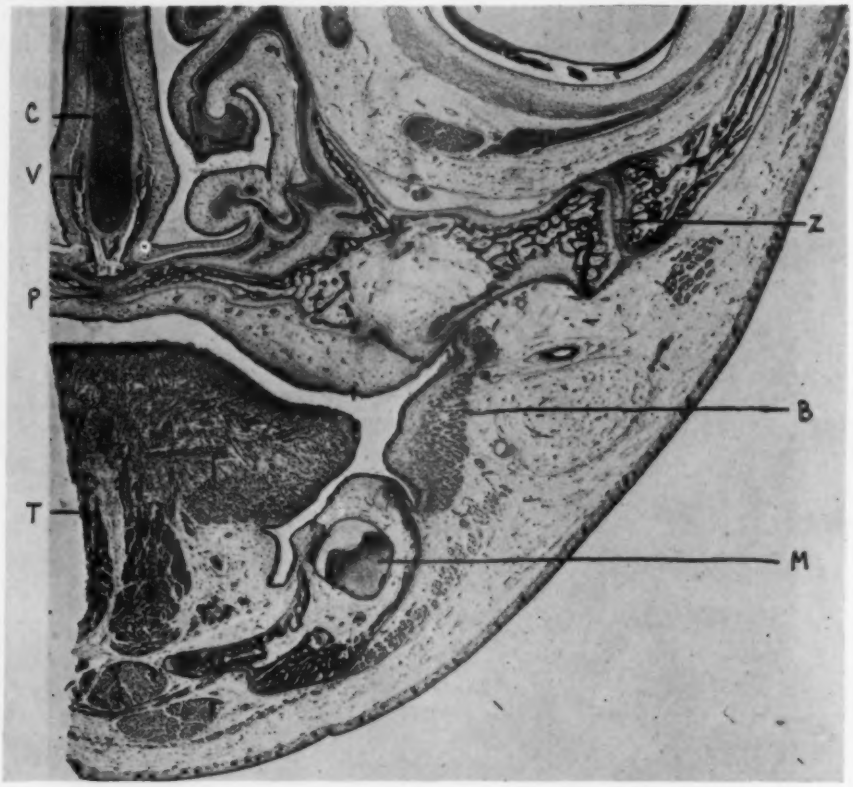

Fig. 6.—Low-power photomicrograph (×5) of same fetus as in Fig. 5 cut in posterior frontal plane. *C*, Cartilaginous nasal septum; *V*, developing vomer; *P*, suture of the hard palate; *T*, tongue; *Z*, zygomaticomaxillary suture; *B*, buccinator; *M*, germ of lower deciduous molar.

Fig. 7 is a low-power (×10) photomicrograph of a frontal section of the nasal septum and hard palate of a 3-year-old child. The marked increase in size of the area and increased complexity of its structures are evident. Resorption of bone on the nasal side of the hard palate at *R* and deposition of bone on the oral side at *D* indicate downward migration of the hard palate.

Deposition of bone can be seen on the developing vomer bone in Figs. 4, 5, 6, and 7. The vomer is a membranous bone which lengthens in the sagittal plane and replaces the lower portion of the cartilaginous nasal septum. The perpendicular plate of the ethmoid bone begins ossification after the vomer when it also

lengthens in the sagittal plane and replaces most of the cartilaginous nasal septum except in the anterior part of the nose. All this septal growth lowers the hard palate in relation to the cranial base.

In Figs. 4, 5, 6, and 7, we can see that the growth of the cartilaginous nasal septum is also correlated with lateral increase in size and complexity of the nasal cavities and the maxillae. Outgrowths from the primitive nasal cavities seen in Fig. 4 give rise to the meatuses of the nose (Figs. 5 and 6). Each middle meatus buds outward to form the maxillary antrum and thus distend the maxilla on its side. We can appreciate the increase in complexity along with the increase in absolute size of the turbinates in Figs. 5 and 6, when they are compared with their condition in Fig. 4.

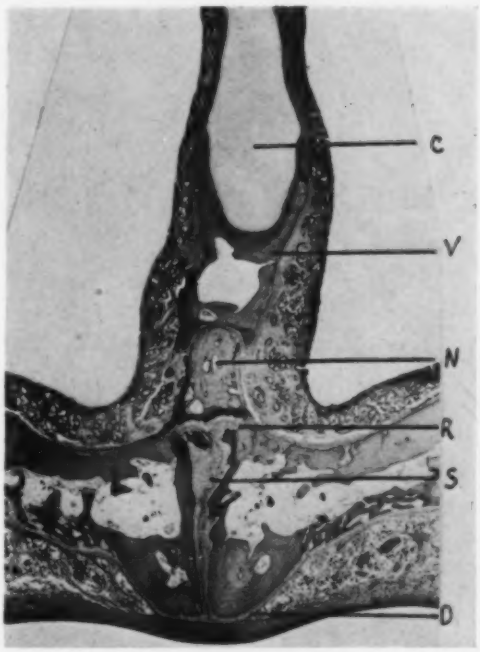

Fig. 7.—Low-power photomicrograph (×10) of part of hard palate, vomer, and nasal septum of a 3-year-old child. There is a marked increase in size of this area and an increased complexity of the structures as compared with Figs. 4 to 6. *C*, Cartilaginous nasal septum; *V*, developing vomer; *N*, nasal spine; *R*, resorption of bone on nasal side of hard palate; *S*, suture of the hard palate; *D*, deposition of bone on oral side of palate.

All this indicates that although bone was being deposited on the floor of the nose in Fig 5, the nose and the palate are migrating downward as the vomer and nasal cartilage increase in vertical dimension (Figs. 4, 5, 6, and 7). Thus the paradox of bone deposition at the floor of the fetal nose can be explained as a thickening of the bone there, rather than as an upward migration of the nose.

After birth, the cranium grows relatively slowly while the face grows rapidly. The cranial base is relatively fixed. During this postnatal period, there is a primary face and tooth expansion, and a secondary brain expansion (Fig. 1).

If we study postnatal histologic material, we note a marked difference from the fetal sections. Thus, Fig. 8 is a low-power (×10) photomicrograph of a partially erupted maxillary central incisor of a child 8½ years old. This specimen shows by the deposition of new bone (*D*) at the apex that the tooth was moving occlusally more rapidly than the root was growing although the alveolar crest (*A*) is still above the cementoenamel junction (*E*). Note the septal cartilage (*C*) just above the bone of the nasal spine. There is *resorption of bone* (*R*) at this point.

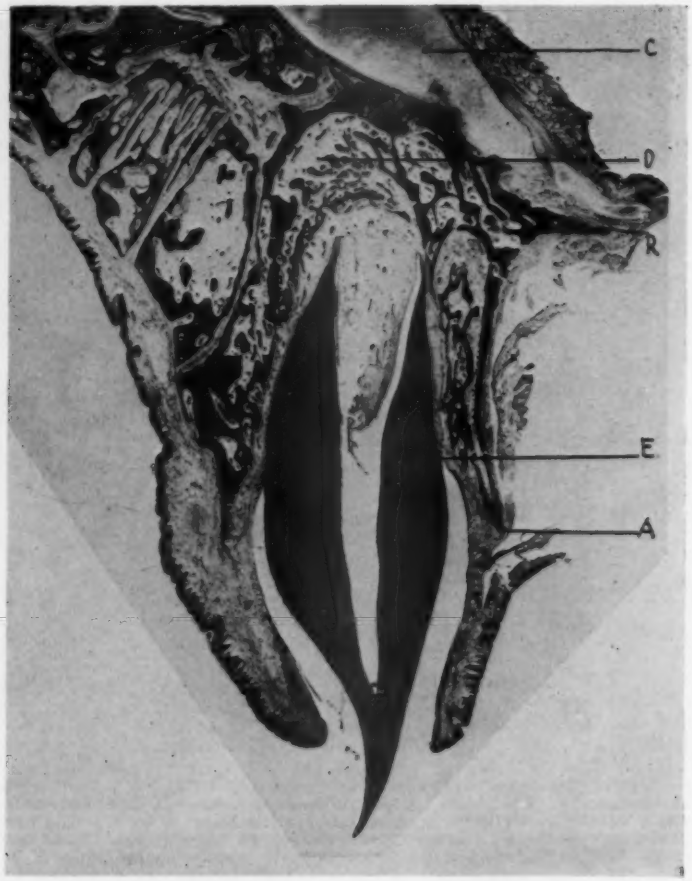

Fig. 8.—Low-power photomicrograph (×10) of a partially erupted maxillary central incisor of a child 8½ years old. *A*, Alveolar crest; *E*, cementoenamel junction; *R*, resorption of bone of nasal spine; *D*, bone deposited at apex of erupting incisor; *C*, nasal septum.

The finding of bone resorption at the floor of the nose in Fig. 8 is just the opposite of bone deposition at the floor of the nose in Fig. 5. But it is in harmony with the findings of the Broadbent school, and indicates a downward and forward migration of the nose.

Fig. 9 is a composite photomicrograph of four labiolingual decalcified sections of maxillary central incisors taken at the same low magnification (×5). The sections are arranged assuming, with Orban,[11] that the floor of the nose is

relatively fixed during the changing positional relationships of deciduous and permanent teeth to the maxilla. We note the differences in size of deciduous and permanent teeth and the changes in the growing jaw occurring simultaneously.

The first section shows the developing enamel organ of the deciduous central incisor of a 4½-month fetus. The second section shows the erupting deciduous central incisor and the forming crown of the permanent central incisor of a 1-year-old child. The third section shows the erupting permanent central incisor of an 8-year-old child. The fourth section shows the fully erupted permanent central incisor of a 20-year-old adult.

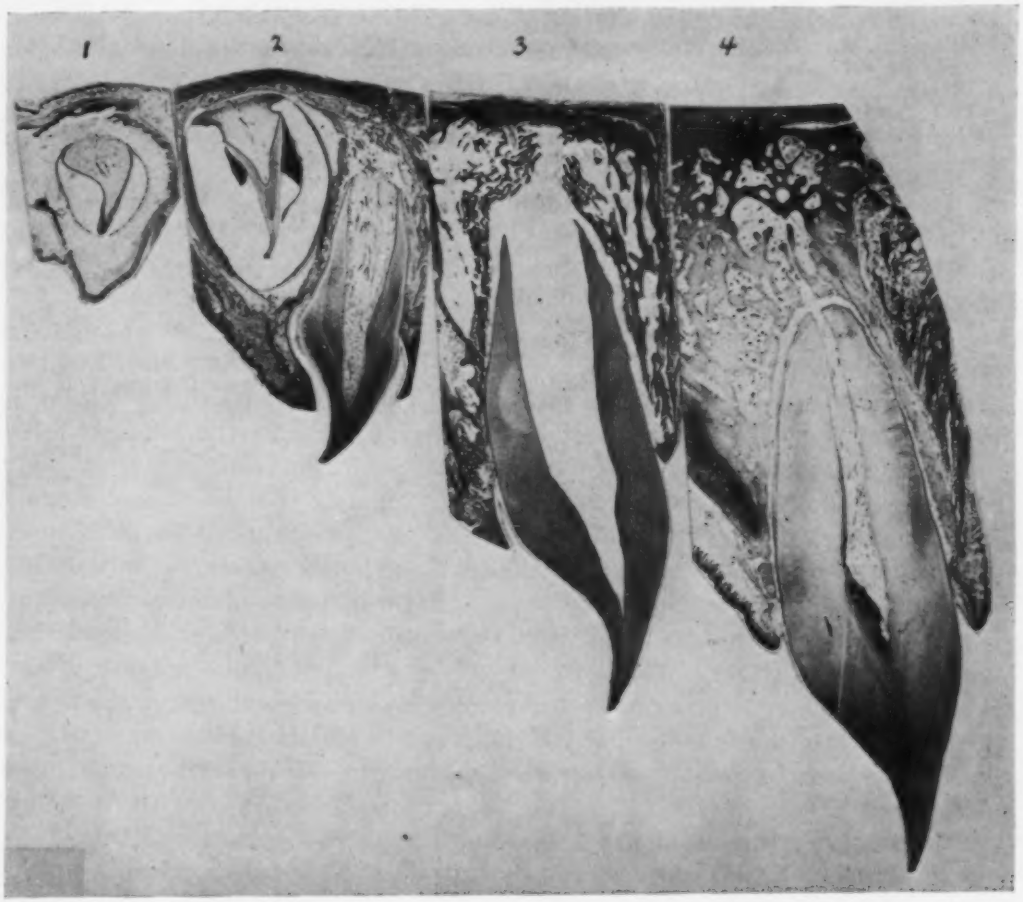

Fig. 9.—Composite photomicrograph of four labiolingual sections of maxillary central incisors (×5). *1*, Developing enamel organ of decidous central incisor of 4½-month fetus; *2*, erupting deciduous incisor and forming permanent incisor of 1-year-old child; *3*, erupting permanent incisor of 8-year-old child; *4*, fully erupted permanent incisor of 20-year-old adult.

While this arrangement of the sections in Fig. 9 is helpful in understanding local growth changes in teeth and jaws, it must be realized that the histologist, because of his limited view—in space and time—in isolated sections—can very well be misled. Orban's original statement that Hertwig's epithelial root sheath is a relatively fixed point in growth was based partly on the asumption that the floor of the nose is a stable point and partly on the assumption that the epithelial root sheath is present in the bell stage of the enamel organ.

But this article offers evidence that the floor of the nose is not a stable point, and it was demonstrated[12] that the epithelial root sheath is not present until the enamel organ has virtually completed the crown of a tooth. Evidently for a more comprehensive understanding of development of jaws and teeth in relation to the cranium, these sections should be oriented in the frame of reference used by the Broadbent school.

REFERENCES

1. Applebaum, E., and Cuttita, J. A.: Development of the Head Illustrated by Sections of Human Fetal Material, Am. J. Orthodontics and Oral Surg. **32**: 327, 1946.
2. Broadbent, B. H.: Ontogenetic Development of Occlusion, Philadelphia, 1941, University of Pennsylvania, Bicentennial Conference, p. 31.
3. Diamond, M.: Patterns of Growth and Development of Human Teeth and Jaws, J. D. Res. **23**: 273, 1944.
4. Brash, J. C.: Some Problems in Growth and Developmental Mechanics of Bone, Edinburgh M. J. **41**: 305, 1934.
5. Noback, C. R.: Developmental Anatomy of Human Osseous Skeleton During Embryonic, Fetal, and Circumnatal Periods, Anat. Rec. **88**: 91, 1944.
6. Massler, M., and Schour, I.: The Growth Pattern of the Cranial Vault in the Albino Rat as Measured by Vital Staining With Alizarin Red "S," Anat. Rec. **110**: 83, 1951.
7. Moore, A. W.: Head Growth of the Macaque Monkey as Revealed by Vital Staining, Embedding, and Undecalcified Sectioning, Am. J. Orthodontics **35**: 654, 1949.
8. Weinmann, J. P., and Sicher, H.: Bone and Bones, St. Louis, 1947, The C. V. Mosby Company, p. 92.
9. Huxley, T. H.: On Some Fossil Remains of Man, in Man's Place in Nature, New York, 1929, D. Appleton & Company, p. 157.
10. Diamond, M.: Development of the Dental Height, Am. J. Orthodontics **30**: 589, 1944.
11. Orban, B.: Dental Histology and Embryology, Chicago, 1928, Rogers Printing Company.
12. Diamond, M., and Applebaum, E.: The Epithelial Sheath: Its Functional Cycle, J. D. Res. **23**: 45, 1944.

GROWTH AND TRANSFORMATION OF THE MANDIBULAR JOINT IN THE RAT THYROIDECTOMIZED AT BIRTH

VII. The Effect of Growth Hormone and Thyroxin Given Separately or in Combination

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THE decided improvement of the facial pattern of cretins following thyroid administration[6, 7, 9, 14] recently has given rise to a discussion of its underlying mechanism. It has been suggested that the growth centers of the mandible respond more promptly to thyroid hormone than do those of the other parts of the skull.[15] In order to learn about the effects of the thyroid hormone upon growth and transformation of the mandibular joint, one may resort to controlled animal experimentation.

A series of articles has given account of the effects of the removal of the thyroid gland in newborn rats. The general thyroprivic symptoms were lack of increase in body size and weight, developmental retardation of the external appearance, and delay of sexual maturation.[11, 12] It has been shown by Koneff, Scow, Simpson, Li, and Evans[8] that thyroidectomy causes the elements of the anterior lobe of the pituitary gland to partially atrophy. Consequently, production of growth hormone is depressed; insufficient output of gonadotropic hormones is responsible for hypogonadism. Histologic studies of long bones of adult thyroidectomized rats[2] revealed absence of secondary centers of ossification and greatly delayed epiphyseal closure due to inhibition of cartilage erosion; the bone structures at 64 days of age resembled those of normal animals at 18 days; the histologic characteristics of the condylar head in sharp contrast, however, never corresponded to those of youth, but showed distortion and greater cartilage width.[4]

Following injections of growth hormone, thyroidectomized rats made significant gains in metabolic rate, body weight, and body size, but retained their infantile appearance[13] and the pituitary cytologic deficiency.[8] Skeletal growth, especially chondrogenesis, was stimulated. However, maturation, and epiphyseal closure in particular, remained almost completely checked.[3]

When treated with thyroxin, thyroidectomized rats not only grew markedly, but they also advanced in maturity. Thyroxin elicited pituitary restitution and

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Appreciation is expressed to Dr. Robert O. Scow, who performed the skillful thyroidectomies on the rats used in this experiment during the first day of their lives, and to Drs. D. A. Collins and R. D. Coleman for their assistance in preparation of this material.

gonadal repair,[8] and stimulated both skeletal growth and maturation primarily through resumption of cartilage proliferation and erosion.[3] The effects of thyroidectomy and substitution therapy upon the dental structures of these same animals have been the objective of a recent study.[1] Normal standards of mandibular growth in the rat have been established histologically by Collins, Becks, Simpson, and Evans.[5]

It is the purpose of this report to describe the changes of the mandibular joint structures of rats thyroidectomized at birth and their response to growth hormone and thyroxin, given separately and in combination.

EXPERIMENTAL ARRANGEMENT

There were available the heads of the rats (Long-Evans strain) which have been used in the experiments previously reported.[1, 13] All experimental animals were thyroidectomized at birth. The present material is composed of five groups (Table I).

TABLE I. EXPERIMENTAL ARRANGEMENT

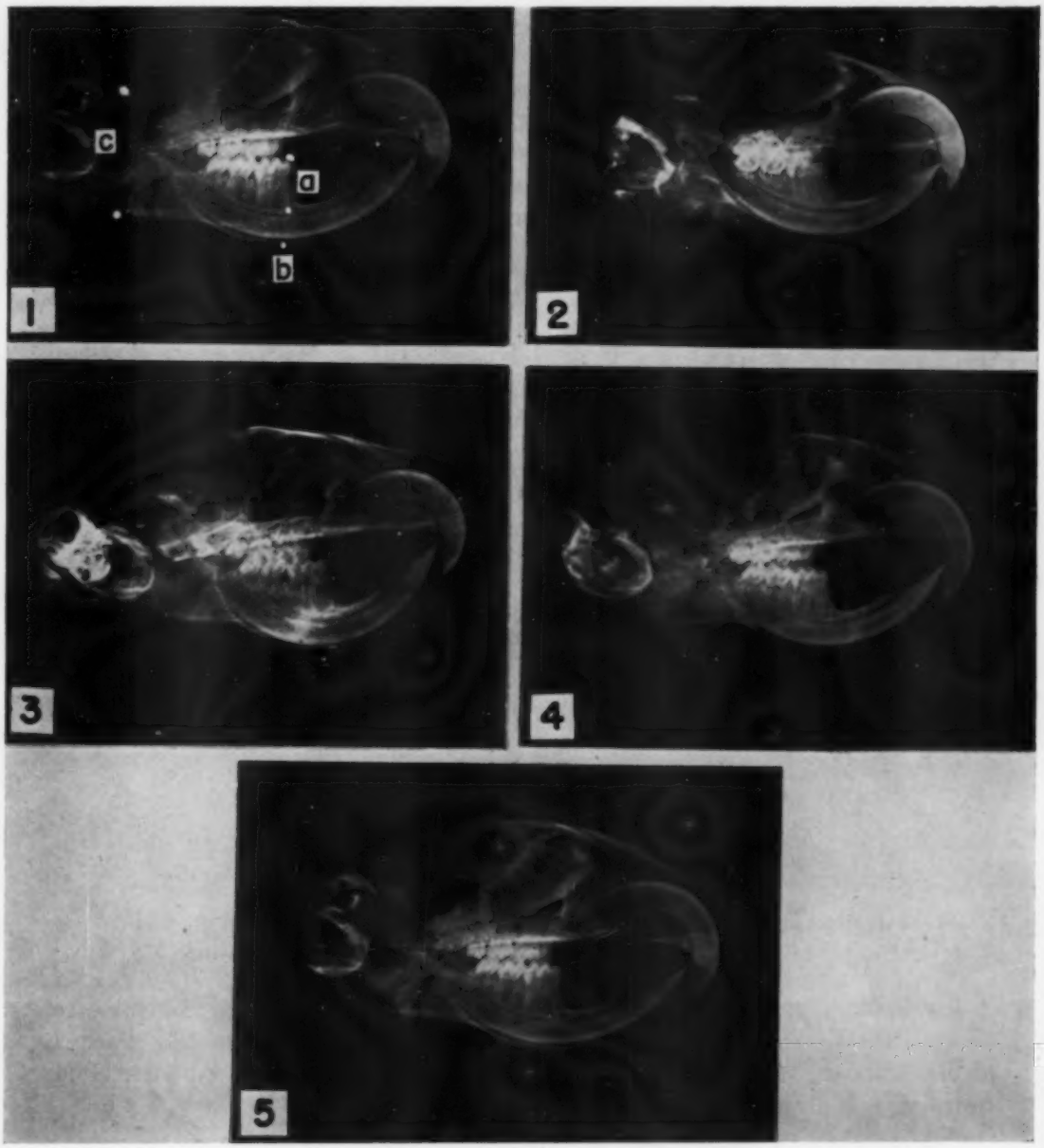
	GROUP	NUMBER OF ANIMALS	THYROIDECTOMY	TREATMENT (EXCEPT SUNDAYS)	AUTOPSY (DAYS)
I	Normal controls	20	—	—	61 to 64
II	Thyroidectomized	6*	At birth	—	61 to 64
III	Thyroidectomized plus growth hormone	6*	At birth	32nd—autopsy 0.5 mg. growth hormone	61 to 64
IV	Thyroidectomized plus thyroxin	11*	At birth	32nd—autopsy 2.5 μg Squibb thyroxin	61 to 64
V	Thyroidectomized plus combination	10*	At birth	32nd—autopsy 0.5 mg. growth hormone 2.5 μg thyroxin	61 to 64

*The criteria for the selection of completely thyroidectomized rats are reported in a previous article.[13]

The first group of normal female and male rats of 63 days of age represents the normal chronological controls. The second group consists of thyroidectomized and untreated animals of 63 days of age which served as operated controls. The third group comprises thyroidectomized animals which received a daily dose of 0.5 mg. of purified pituitary growth hormone intraperitoneally from their thirty-second to sixty-third day of life. The fourth group was injected with 2.5 μg of Squibb crystalline thyroxin solution subcutaneously for thirty-one days. The fifth group was given injections of both growth hormone and thyroxin in the doses specified previously.

The heads of the control and experimental rats were split in half and roentgenographed. Then the following measurements were taken from the roentgenograms: (a) The upper mandibular body height, measured from the tip of the mesial cusp of the first mandibular molar perpendicularly to the superior alveolar wall of the lower incisor (Fig. 1, *a*); (b) the total mandibular body height, measured from the occlusal surface of the first molar perpendicularly to the lower border of the mandible (Fig. 1, *b*); (c) the ramus height, taken from the highest point of the condyle perpendicularly to the lower border

of the mandible (Fig. 1, *c*). The group averages with standard deviations are computed in Table II. For the purpose of comparison, the lengths of the tibias also have been measured; they are included in the table.



Figs. 1 to 5.—Roentgenograms. (Magnification, ×5.)

Fig. 1.—Normal control, 63 days of age. Sp. 9341. *a*, Upper mandibular height; *b*, mandibular height; *c*, ramus height.

Fig. 2.—Thyroidectomized control, 63 days of age. Sp. 9251, W23.

Fig. 3.—Thyroidectomized at birth and growth hormone-injected from the thirty-second to sixty-third day of age. Sp. 9252, BH15.

Fig. 4.—Thyroidectomized at birth and thyroxin-administered from thirty-second to sixty-third day of age. Sp. 9256, G26.

Fig. 5.—Thyroidectomized at birth and growth hormone and thyroxin-administered in combination from the thirty-second to sixty-third day of age. Sp. 9262, B06.

The right mandibular joints were dissected, decalcified in 5 per cent nitric acid, embedded in nitrocellulose, sectioned in the mediolateral direction, and stained with hematoxylin and eosin.

FINDINGS

A. Roentgenographic and Metric Data.—The skulls of a normal rat and a thyroidectomized littermate at 63 days of age may be seen in Figs. 1 and 2. Dwarfed cranial dimensions and delayed dental development are conspicuous features of the thyroidless rat. The eruption stage of third molars at the sixty-third day of life corresponds to the normal conditions at 30 days in contrast to the bone age, which matched the normal condition of 18 days.[2] Metric data (Table II) lag one-fourth behind the normal dimensions.

Under the influence of the growth hormone, administered for thirty-one days, the cranial structures show a remarkable increase in size (Fig. 3). The incisors appear little larger than those of untreated animals; the third molars have erupted fully, showing more than half of the roots formed. The mandibular dimensions have reached approximately 85 per cent of the normal average (Table II).

TABLE II. MEAN VALUES OF MANDIBULAR MEASUREMENTS (MM.)

	GROUPS	NO.	STATISTICAL VALUE	UPPER MANDIBULAR BODY HEIGHT	MANDIBULAR BODY HEIGHT	RAMUS HEIGHT	TIBIA LENGTH
I	Normal control	20	M	4.77	8.20	10.47	34.40
			σ	±0.32	±0.32	±0.59	±1.69
II	Thyroidectomized control	6	M	3.86	5.90	7.59	22.00
			σ	±0.29	±0.48	±0.26	±0.67
III	Thyroidectomized and growth hormone-injected	6	M	4.40	6.70	8.90	24.60
			σ	±0.30	±0.29	±0.26	±0.85
IV	Thyroidectomized and thyroxin-injected	11	M	4.16	6.74	8.72	29.30
				±0.17	±0.21	±0.44	±1.35
V	Thyroidectomized and combination	10	M	4.36	6.94	9.62	30.00
			σ	±0.28	±0.20	±0.51	±1.74

M—Mean

σ—Standard deviation

Upper Mandibular Body Height: First molar, occlusal = lingual alveolar plate incisor.
Mandibular Body Height: First mandibular molar, occlusal = lower mandibular border.
Ramus Height: Condylar head—lower mandibular border.

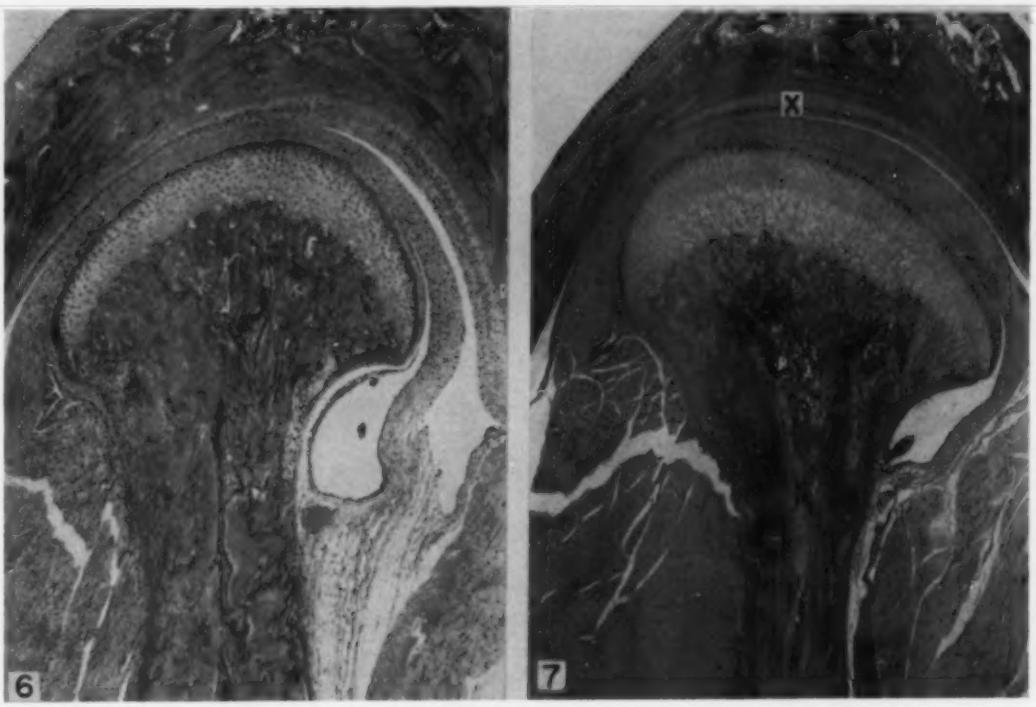
The skulls of the thyroxin-injected animals (Fig. 4) show a restitution of dental development similar to the growth hormone-injected group. Measurements, however, reveal little less increase in mandibular dimension, particularly in upper mandibular body height.

After both thyroxin and growth hormone have been administered concurrently (Fig. 5) the dental development, as judged by the root formation of the third molars, is restored to normal. The mandibular dimensions remain, however, beyond normal average and only slightly above the growth hormone-treated group.

B. Histologic Data.—The shape of the glenoid fossa and condylar head, the width of the articular cartilage, and the structure of the ramal bone are the

characteristics of the mandibular joint that are prone to change with advancing age and under endocrine influence.

The normal histologic condition of a 63-day-old rat is illustrated in Fig. 6. The condylar head is typically mushroom shaped and the fossa has an ovoid form, with the steeper curvature to the buccolateral side. Here some modeling resorption occurs, while on the lingual surface a few lamellae are deposited, effecting a lateral displacement of the fossa. The circumference of the condyle runs almost parallel to the bony fossa separated from it by the fibrous disc and the synovial membranes. The articular cartilage still comprises numerous cell layers of the characteristic zonal arrangement. A wide embryonic zone at



Figs. 6 and 7.—Microphotographs of mediolateral sections of mandibular condyle of rats. Hematoxylin and eosin stain. (Original magnification, ×68.)
Fig. 6.—Normal, 63 days old. Sp. 9310, Pl. B1483.
Fig. 7.—Thyroidectomized at birth, 63 days old. Sp. 9318, BH131, P1995.

the buccolateral periphery points to an upward and outward direction of condylar growth. The intermediate zone and the vesicular zone are evenly distributed; some intercellular matrix is present between the short chondrocytic columns. At the zone of erosion numerous open marrow spaces and coarse, anastomosing trabeculae, indicate active endochondral ossification. The neck and shaft of the ramus are composed of cortical bone interspersed with slender longitudinal marrow spaces which contain an osteogenically active endosteum and hemopoietic tissue. The lingual surface shows evidence of modeling resorption, while the buccal plate beyond the neck displays periosteal apposition; both processes effect an increase in intercondylar width.

Figs. 8 to 10.—Microphotographs of mediolateral sections of mandibular condyle of rats. Hematoxylin and eosin stain. (Original magnification, ×68.)

Fig. 8.—Thyroidectomized at birth and growth hormone-injected from the thirty-second to the sixty-third day of age. Sp. 9332, BH120, Pl. B1903.

Fig. 9.—Thyroidectomized at birth and thyroxin-administered from the thirty-second to sixty-third day of age. Sp. 934, B80, Pl. B1982.

Fig. 10.—Thyroidectomized at birth and given growth hormone and thyroxin in combination from the thirty-second to the sixty-third day of age. Sp. 9350, B43, Pl. B1964.

The mandibular joint structures of the thyroidectomized rats are dwarfed and distorted. The glenoid fossa and condylar head show, in contrast to the normal shape, the lesser curvature to the lingual side. In Fig. 7 a layer of hypercalcified cartilage borders the glenoid fossa at *x*, manifesting the aplastic state of the osteogenic tissues. The condylar cartilage is relatively wider than normal due to an enlarged vesicular zone which contains irregularly arranged vacuolated chondrocytes in an abundant, partly calcified matrix. As the embryonic zone is developed only at the lingual slope, chondrogenesis evidently proceeds in an upward direction without the normal lateral component. The rate of endochondral ossification does not keep up with that of chondrogenesis. Erosion of cartilage and formation of new trabeculae have almost ceased, as only very few vessels are penetrating into this zone. Neck and body of the ramus are thin and dense. Endosteal ossification has obliterated most of the marrow spaces. The scanty myeloid tissue shows fibrous degeneration. Periosteal ossification proceeds at a very slow rate as judged from the diminutiveness of the apposited lamellae at the buccal periphery. Some modeling resorption occurs at both surfaces of the neck and the entire lingual surface, giving the ramus an inside distorted form.

Upon administration of growth hormone, the condylar head has assumed a piriform shape (Fig. 8). The glenoid fossa is conformingly pointed ovoid, covered by a massive layer of chondrosteoid tissue. The prominent histologic feature consists of the conspicuous amount of condylar cartilage with its very prominent vesicular zone. This condition is comparable to that of a young normal rat of 15 to 25 days of age. While chondrogenesis is greatly activated, the process of erosion seems to be detained, as large islands of residual cartilage remain within the newly formed trabeculae. Numerous osteoblasts and osteoid seams reveal acceleration of periosteal and endosteal ossification effecting a thickening of the ramus. Modeling resorption, however, appears deficient and probably is responsible for the absence of the typical condylar neck. Marrow spaces are numerous but contain only a small amount of hemopoietic tissue.

Following thyroxin substitution therapy, the mandibular joint structures are more regular, with reference to shape and histologic appearance (Fig. 9). Active vascular erosion reduces the cartilage to a width which corresponds to that of a 63-day-old normal control animal. The trabeculae are straight and parallel, bordered by numerous osteoblasts and marrow tissue of the hemopoietic type. Due to adequate modeling resorption at the neck, the condyle has assumed a more regular form. The cortical bone of the ramus, however, appears denser than normal.

Concurrent administration of growth hormone and thyroxin produces properly formed articular structures (Fig. 10). Histologically, the width of the condylar cartilage is greater than normal, due to a prominent vesicular zone. A small amount of little-calcified cartilage matrix is interposed between the regularly arranged columns of vacuolated chondrocytes. Endochondral ossification is intensive at the zone of erosion, as indicated by abundant capillary tufts and numerous delicate trabeculae. This condition is comparable to a normal

bone age of 25 days. The bone of the ramus also has a juvenile appearance; there are large and abundant marrow cavities occupied by a hemopoietic myeloid tissue. Periosteal ossification is marked at the buccolateral side, while modeling resorption prevails at the lingual aspect to the effect that the ramus is thicker than in any other experimental groups.

DISCUSSION

Metric and histologic examination clearly demonstrate that the head of the condyle constitutes a sensitive responding organ to the thyroid hormone. In addition to the well-known effect on general cell metabolism, this hormone exerts a specific influence upon endochondral ossification, mainly with two points of attack, cartilage proliferation and cartilage erosion. After thyroidectomy, chondrogenesis at the condylar head was stunted and erosion of cartilage and endochondral ossification remained nearly checked. These observations are at concurrence with those made in the epiphyseal discs of long bones.[2] The deficient growth activity of the cartilage induced some incoordinated periosteal ossification leading to the deformation of the articular structures, the glenoid fossa and the condylar head.

Thyroid dwarfism of the mandible was greatly improved upon administration of growth hormone. Eighty-five per cent of the normal mandibular dimensions were reached in one-half of the physiologic time (from 32 to 63 days of age). The primary point of attack of the growth hormone obviously was the cartilage and the connective tissues in general, which were rejuvenated to an extent of a 15- to 25-day-old normal rat. Cartilage erosion, as well as modeling resorption, remained deficient and was responsible for the youthful form of the condyle. This confirms the concept previously obtained[13] that growth hormone promotes skeletal growth without differentiation.

Thyroxin had the potency to induce maturation as well as increase in size. In restoring the specific equilibrium between cartilage proliferation and cartilage erosion, together with a correlated rate of ossification, the condylar structures resumed a histologic appearance similar to the chronological controls. However, their size remained approximately 20 per cent beyond the average of the normal controls and somewhat behind the growth hormone-treated group. This finding is not in conformity with that in the long bones which quantitatively responded far less to growth hormone than to thyroxin (Table II).

This surprising discrepancy may be explained by the fact that the mandible is primarily a membranous bone, the elongation of which depends as much upon endochondral as upon periosteal ossification, while long bones are lengthened exclusively through endochondral bone formation. In the complete absence of the thyroid gland, growth hormone apparently is only able to promote little endochondral ossification, while it primarily stimulates chondrogenesis and periosteal bone formation. This activation of membranous osteogenesis is revealed by the maximum increase in upper mandibular body height of the growth hormone-treated group (Table II).

Combined administration of growth hormone and thyroxin showed the beneficial effects of both. The mandibular ramus reached almost the size of the normal controls and maturation was greatly advanced, although less than the thyroxin-treated group. This is due to the potent rejuvenating influence of growth hormone.

The fact that none of the experimental animals regained normal ramal dimensions may be explained with the time schedule of the experiments. Since the hormones were administered after the greatest physiologic growth spurt (between 1 to 32 days), they had to make up for it in a period of 32 to 63 days, which physiologically shows a slowing of the growth processes. On the basis of the combined arrangement of this experiment the polyglandular effect of thyroidectomy previously mentioned,[8] namely, as hypophyseal syndrome is confirmed. The deficiency of the pituitary growth hormone as a sequence of thyroidectomy evidently is responsible for stunted chondrogenesis. Although thyroxin administration restored this pituitary defect, it was never potent enough to boost the stunted mandibular growth to normal dimensions. Similar observations were made cephalometrically in treated hypothyroid children.[6] While thyroxin apparently controls chondrogenesis only indirectly, it directly presides over cartilage erosion and endochondral ossification. This can be concluded from the inadequacy of the latter processes in the growth hormone-treated group and their full restoration in both the thyroxin-treated and combination groups in spite of the fact that parathormone was deficient in all the experimental groups.

SUMMARY

In order to assess the effects of the thyroid gland on the structures of the mandibular joint, a roentgenographic and histologic study was carried out with four groups of experimental rats which were thyroidectomized at birth and sacrificed at 63 days of age. One group served as thyroidectomized controls, another was given pure pituitary growth hormone for thirty-one days, the next group was supplemented with thyroxin for the same period of time, and the last group was treated with both growth hormone and thyroxin. A series of normal 63-day-old rats were used as normal controls.

1. The thyroidectomized rats showed dwarfed and deformed mandibular joint structures incomparable to any age controls. The prominent histologic defects consisted of stunted chondrogenesis and nearly arrested cartilage erosion and depressed modeling resorption.

2. Growth hormone restored the mandibular dimensions by virtue of marked activation of chondrogenesis and membranous osteogenesis. As chondroclasia and osteoclasia, however, remained deficient, the joint structures exhibited a juvenile, immature appearance.

3. Thyroxin administration promoted maturation of the mandibular condyle to the extent of the normal age controls, but without restoring the normal mandibular dimensions or even those of the growth hormone-treated group. These significant findings are at variance with those made in the tibias and may be

attributed to the fact that in the absence of the thyroid gland, growth hormone does not seem to be able to promote endochondral ossification, but stimulates, for the main part, chondrogenesis and periosteal bone formation.

4. Combined supplement of growth hormone and thyroxin elicited an increase in size over the extent of any of the previous groups to almost normal size, while maturation was accelerated more than in the growth hormone-injected group, but less than in the thyroxin-treated group.

Experimental evidence thus is procured that proper mandibular development and a good facial pattern are dependent upon normal thyroid function. Severe thyroid deficiency during the growth periods causes stunting and discordance of the growth processes at the condylar head. Thyroxin supplement proves to be unable to restore full normal dimension, apparently on account of a hypophyseal syndrome which is only partly reversible. Combined treatment with growth hormone and thyroxin showed the best results in the control of thyroprivic mandibular symptoms.

REFERENCES

1. Baume, L. J., and Becks, H.: The Effect of the Thyroid Hormone on Dental and Paradental Structures, Int. J. Paradent. **6**: 89, 1952.
2. Becks, H., Simpson, M. E., Scow, R. O., Asling, C. W., and Evans, H. M.: Skeletal Changes in Rats Thyroidectomized on the Day of Birth and the Effects of Growth Hormone on Such Animals. Tibial, Metacarpal, and Caudal Vertebrae, Anat. Rec. **100**: 561-576, 1948.
3. Becks, H., Scow, R. O., Simpson, M. E., Asling, C. W., Li, C. H., and Evans, H. M.: Response by the Rat Thyro-parathyroidectomized at Birth to Growth Hormone and to Thyroxin Given Separately or in Combination. III. Skeletal Changes: Tibia, Metacarpal, Caudal Vertebrae, Anat. Rec. **107**: 299-318, 1950.
4. Becks, H., Collins, D. A., Asling, C. W., Scow, R. O., Simpson, M. E., and Evans, H. M.: Growth and Transformation of the Mandibular Joint in the Rat. IV. The Effects of Thyroidectomy at Birth, Oral Surg., Oral Med., & Oral Path. **1**: 315-318, 1948.
5. Collins, D. A., Becks, H., Simpson, M. E., and Evans, H. M.: Growth and Transformation of the Mandibular Joint in the Rat. I. The Normal Female Rat, Am. J. Orthodontics **32**: 431-451, 1946.
6. Engel, M., Bronstein, J. P., Brodie, A., and Wesoke, P.: Roentgen-Cephalometric Appraisal of Untreated and Treated Hypothyroidism, Am. J. Dis. Child. **61**: 1193, 1941.
7. Franceschetti, A., Bamatter, F., and Klein, D.: Late Improvement of a Case of Congenital Athyroid Dwarfism with Intrasellar Alteration, Bull. Acad. Suisse Sc. Med. **2**: 274, 1947.
8. Koneff, A. A., Scow, R. O., Simpson, M. E., Li, C. H., and Evans, H. M.: Response by the Rat Thyro-parathyroidectomized at Birth to Growth Hormone and to Thyroxin Given Separately or in Combination. II. Histological Changes in the Pituitary, Anat. Rec. **104**: 465-476, 1949.
9. Nicolas, G.: Un Cas Rare d'Athyroidie Congenitale, Revue Mensuelle Suisse d'Odont. **61**: 616, 1951.
10. Reinhardt, W. O.: Method for Determining Completeness of Thyroidectomy Using Radioactive Iodine, Proc. Soc. Exper. Biol. & Med. **50**: 81-84, 1946.
11. Salmon, T. N.: The Effect on Growth Rate of Thyro-parathyroidectomy in Newborn Rats and of the Subsequent Administration of Thyroid, Parathyroid, and Anterior Hypophysis, Endocrinology **23**: 446-457, 1938.
12. Scow, R. O., and Simpson, M. E.: Thyroidectomy in the Newborn Rat, Anat. Rec. **91**: 209, 1945.
13. Scow, R. O., Simpson, M. E., Asling, C. W., Li, C. H., and Evans, H. M.: Response by the Rat Thyroparathyroidectomized at Birth to Growth Hormone and to Thyroxin Given Separately or in Combination. I. General Growth and Organ Changes, Anat. Rec. **104**: 445, 1949.

14. Schour, I.: Effect of the Endocrines on the Teeth, Jaws, and Facial Skeleton, Proceeding of the Dental Centenary Celebration, 1940, p. 145.
15. Weinmann, J. P., and Sicher, H.: Pathology of the Temporomandibular Joint. In Sarnat, B. G. "The Temporomandibular Joint," Springfield, Ill., 1951, Charles C Thomas.

Erratum

In the article by Dr. Herbert I. Margolis entitled "A Basic Facial Pattern and Its Application in Clinical Orthodontics. II. Craniofacial Skeletal Analysis (Cont'd), and Dento-Craniofacial Orientation," which appeared in the June issue of the JOURNAL, the letters "FCA" in line 13 of page 427 should be "CSA." On page 438 of the same article, the last word in line 2, paragraph 3, should be "mouth" instead of "mount."

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The Eskimo's Dentofacial Complex. Effects of Environmental and Genetic Factors: By George V. Newman, First Lieutenant, Dental Corps, United States Army. *U. S. Armed Forces M. J.* **3**: 1653-1662, 1952.

In the summer of 1951, the author examined and treated the teeth of Eskimos in Greenland. At the same time he accumulated statistics on the caries, occlusions, and transverse palatal dimensions of these people.

About 130 natives reside in the Eskimo village in Thule, northwest Greenland. A small trading station is located in the Danish village (population, 40 Danes) about one mile away. The original southwest Greenland Eskimo population has become mixed with the white population to a large degree, but in the Thule district the Eskimo element predominates. The last migration of Canadian Eskimo to Greenland, affecting the inbreeding and genetic balance of the Eskimo in the Thule district, occurred about ninety years ago.

The range of height of the Eskimo man is from 60 to 65 inches and of the Eskimo woman, from 58 to 60 inches. They are powerfully built with broad chests and short, thick arms and legs. The face of the Eskimo is pentagonal in shape and has a wide bizygomatic and bigonial breadth. Bimaxillary protrusions are common. The palate is long and broad; a palatal torus is often present. The mandible is heavy and has a high stout body and the ascending rami are broad and low. Mandibular tori are common.

The modern Eskimo eats a mixed diet. Vegetation is negligible in northwest Greenland. During the winter they eat fish, seal, walrus, polar bear, whales, polar hare, and auks. The meat and fish are eaten raw or semicooked. If the hunting is poor, they may supplement this diet with tea, biscuits, canned foods, and other items from the near-by Danish trading store. The proportion of carbohydrate in their diet is increased in the summer. Stefansson stated that the primitive diet consisting mainly of meat and fish (65 per cent protein and 35 per cent fat) contains all the minerals and vitamins necessary for [dental] health. Vitamins A, C, and D are found in the glandular viscera of the fatty sea creatures previously mentioned.

The Eskimos in this region have well-developed alveolar processes, form and size of the jaws, and lack observable hypocalcification of the enamel of the teeth.

Although the modern Eskimo indulges in a relatively softer diet than his forefathers, he partakes of the seal, walrus, and other raw meats, whose fibrous consistency is a factor in the attrition of his teeth as well as the overdevelopment of his muscles of mastication and jawbone.

In order to study the incidence of caries among the Eskimos, the author also examined, with mouth mirror and explorer, 55 adults (aged 18 to 50 years) and 40 children (aged 6 to 17 years) in the Danish village hospital and in the Eskimo village. On the basis of these findings and those of other investigators, the following conclusions are drawn: (1) the incidence of caries is higher in female adults and children than in males; (2) there has been a progressive

increase in the per cent of persons with caries and in the per cent of carious permanent teeth, as compared with the earlier findings in small trading stations; (3) the incidence of caries among Eskimos is higher in children than in adults; (4) studies of primitive Eskimo skulls show negligible caries rates as compared with the rampant caries observed among the modern Eskimos; (5) Eskimos living in outposts have less caries than those living in main trading stations; and (6) the increase in caries among the Eskimos is in proportion to the increase in their carbohydrate intake.

Microscopy has shown that there is a higher proportion of microscopic and macroscopic surface irregularity in the enamel of the west Greenland Eskimos than in that of white persons. The course of the perikymata is more irregular and the prevalence of lamination and reticulation is much greater in the west Greenland Eskimos than in white persons. An added causative factor in the rampant caries observed in the Eskimo may be a lowered resistance to the penetration of bacteria due to the increased irregularities in their enamel. Although the Eskimos' teeth (ancient and modern) are apparently more susceptible to decay than those of white persons, their increased carbohydrate intake appears to be the most important factor in the increased incidence of caries.

The per cent of malocclusion in primitive Eskimo skulls was reported by Leigh as being only 11.4 per cent among the adults. Most of these would fall in Class I. The author surveyed the group of Eskimos, classifying their occlusion according to the Angle system. Persons whose upper and lower arches were in normal mesiodistal relationship as far as their molars were concerned, but whose upper incisors were in labioversion or in linguoversion to the lower incisors, whose upper anterior teeth were crowded, whose canines were in axioversion, labioversion, linguoversion, or infraversion, who had rotation or buccoversion or linguoversion of the premolar or molar, and in whom the maxillary permanent first molars on both or one side had shifted mesially, although the mandible appeared to be in the proper relationship to the maxilla and cranium, were placed in Class I. Open-bites and cross-bites were included.

There was no significant difference found in the occlusions of the male and female Eskimos. The higher per cent of malocclusions in children may be attributed to the fact that part of their teeth were deciduous. Prolonged retention of deciduous teeth or roots and premature loss of deciduous teeth were contributing factors. Carious lesions causing complete or partial loss of the crowns, resulting in shifting of teeth, extrusion, food impactions, and attrition with its concomitant loss of interproximal contacts and inclined planes, resulting in periodontal traumatism, were all conducive to local malocclusions among the Eskimos.

Edge-to-edge bites were common among the native adults. Children under 13 showed much less attrition of the occlusal surfaces of the teeth as compared to adults, and showed slight to moderate overbite and overjet of the anterior teeth. Open-bites were observed, but posterior cross-bites were rare.

The altered diet of the modern Eskimo seems to be a factor in the increase of malocclusions in recent years. The higher per cent of local anterior deviations (Class I) and normal molar relationships indicate etiologic localized and genetic factors, respectively. Although a large per cent of the modern Eskimos possess well-developed jaws and arches in proper mesiodistal relationship, they have a high incidence of caries. There appears to be no correlation between caries resistance, jaw growth and development, and arch relationship in these Eskimos.

Mouth breathing is prevalent among Eskimos. The hypothesis, cited by some orthodontists, that mouth breathing causes narrow arches and Class II, Division 1 malocclusions is untenable in respect to these mouth breathing natives with broad-arched palates.

Comparisons of the teeth in primitive Eskimo skulls and modern Eskimos over 35 years of age show a similar pattern of attrition of the occlusal molar surfaces due to the rugged character of their diet. The occlusal surface slopes down from the higher buccal to the lower lingual cusp on the upper molars, while the lower buccal cusps slope up to the higher lingual cusps on the lower molars. As a result, abnormal forces of mastication are set up during excursions, causing resorption of the lingual alveolar process and gingiva on the upper molars with a concurrent loss of alveolar and gingival structures on the buccal surfaces of the lower molars. The resulting periodontal traumatism not only causes periodontal pockets, but apparently affects the temporomandibular joint, as well.

A study of the temporomandibular articulation of primitive Eskimo skulls reveals resorption of the articular eminence, a reduction of the angle of the articular eminence, and flattened articular surfaces of the condylar head due to resorption. The coarse consistency of the Eskimo diet may have acted as an orthodontic appliance by obliterating the inclined planes of the occlusal surfaces, thereby transmitting excessive stress during lateral mastication to the temporomandibular joint, resulting in an alteration of these extra-alveolar bony contours and finally causing an edge-to-edge bite.

The controversial problem of whether the broad U-shaped arches of the Eskimo are the result of increased function or due to hereditary influences is frequently encountered during the study of the dentofacial complexes of these people.

The transverse palatal diameters of the adult Eskimos examined showed variable thickened alveolar processes, particularly in the molar area, as compared with those of the children. The author concluded that because an adult had used his teeth for a longer time, his alveoli had adapted to the functional stress by the apposition of supporting bone. Because the width of the transverse palatal arch would be a variable measurement depending on the physical consistency, musculature, etc., he decided to delineate the genetic factor by measuring the palatal arch widths with a Boley gage as follows:

Intermolar Width.—The width of the palate was measured posteriorly between points on the buccal surfaces of the first molars. These points were taken between the middle and distobuccal cusps.

The *intercanine width* was taken between the maxillary canines at the height of greatest curvature on the labial surfaces at about the midpoint of the mesiodistal diameter.

Analysis.—The palatal arch widths of the male (primitive and modern) are larger than those of the female. Furthermore, the similarity of measurements (mean, range, and standard deviation) indicates an inherent genetic pattern between primitive and modern Eskimos in so far as palatal arch width is concerned.

Measurements of the palatal arch widths of Eskimo children between the ages of 8 and 12 years showed that 93.1 per cent of the mean adult male intermolar arch width was attained in boys and 95.7 per cent was attained in girls; 96.8 per cent of the mean adult intercanine arch width was attained in boys and 96.7 per cent was attained in girls.

The fact that the modern Eskimo's diet has been altered in comparison with the primitive Eskimo does not seem to have affected the intercanine and intermolar arch widths, but the transverse palatal dimension between the 2 buccoalveolar processes may be affected in proportion to the masticatory forces. This is merely another corroboration of the plasticity of bone in responding to functional stress. Furthermore, on the basis of the similarity of palatal arch widths and the prevalence of normal occlusions, it can be stated that despite the intermixture of white racial strains, the normal, molar mesiodistal relationships, and the broad, well-developed arches of the natives are genetically dominant.

The diet of the primitive Eskimo contained all the vitamins and minerals essential for normal dental health. That of the modern Eskimo includes a greater proportion of carbohydrate foods. Primitive Eskimos had practically no caries, but dental decay is becoming increasingly prevalent among the modern Eskimos. A greater per cent of malocclusion was observed among modern as compared with primitive Eskimos. Most of the adults observed had normal occlusions. Most malocclusions were Class I; none were Class II; and a small per cent were Class III. The tendency toward inheritance of normal occlusion among the Eskimos appears to be greater than that toward inheritance of abnormal occlusion although variations were observed. Edge-to-edge bites were prevalent among adults, while children under 14 years of age showed overbites and overjets. Edge-to-edge bites could be considered the result of the abrasive quality of the diet.

The altered diet of modern Eskimos seems to be a factor in the increase of malocclusions as compared with primitive Eskimos. The greater per cent of local anterior deviations (Class I) and normal molar mesiodistal relationships indicates localized etiologic and genetic factors, respectively. There appears to be no correlation between caries resistance and jaw growth and development, or between caries resistance and arch relationships in the Eskimos.

The opinion that mouth breathing is an etiologic factor in narrow arches and Class II malocclusions is untenable among the mouth breathing Eskimos with broad-arched palates. The physical consistency of the Eskimo diet has caused attrition of the occlusal surfaces of the teeth, periodontal traumatism, and seems to have caused an alteration in the bony contours of their temporomandibular joints.

As far as the molar mesiodistal relationship (occlusion) and palatal arch widths and contours are concerned, there has not been sufficient intermixture of white racial strains nor change in the type of diet to suppress the previously mentioned dominant hereditary factors in the Eskimos which have been stabilized through centuries of natural selection and inbreeding.

News and Notes

First Golden Anniversary Luncheon of the American Association of Orthodontists

Late last fall it was suggested that the American Association of Orthodontists honor and pay tribute to its members who had graduated in dentistry fifty or more years ago. President Brooks Bell started the ball rolling by appointing a committee composed of Dr. W. R. Humphrey of Denver, Dr. L. J. Porter of New York, and Dr. E. N. Bach of Toledo who served as chairman. This committee was on its way the next day. Things looked easy at first, but we soon found there was work to be done. Many questions arose. How many such men are there? Who are they? Where are they located? How will we find out whether or not they are living? Secretaries of all constituent societies, Dr. Squires, Dr. Bell, and

Honored guests and members of the committee responsible for the First Golden Anniversary Luncheon of the American Association of Orthodontists.

Front table, seated from left to right: Drs. Leuman M. Waugh, Orville VanDeusen, Hugh T. Berkey, Oliver W. White, Earl W. Swinehart, C. M. McCauley, Charles R. Baker, William J. Speers, and John E. Taylor.

Rear table: Committee members William R. Humphrey, Ernest N. Bach, Brooks Bell, and Lowrie J. Porter.

Dr. Baker were asked to send a list of all such men to the chairman as soon as possible. All cooperated wonderfully. Their lists, together with the names and addresses we found in old orthodontic directories, gave us a list of 111 names. These names were sent to the others of our committee, Dr. Bell, Dr. Squires, and Dr. Baker included. All were checked again and returned to the chairman. Many had passed on. To make a long story short, there were thirty-eight members in our final list.

A personal questionnaire was sent to each man. After all were returned, a formal invitation and complimentary luncheon ticket were mailed to each, R.S.V.P. We were surprised to find that a large number were ill, unable to travel any distance, or had illness in their families. Nine members attended the First Golden Anniversary Luncheon in their honor in Dallas, Texas, on April 27, 1953.

It is the hope of our committee that these men present will continue some form of an organization to be known as the Golden Anniversary Group, or some other name, and elect officers who will take care of all details of future meetings, holding one such meeting or luncheon in connection with the annual meetings of the American Association of Orthodontists. Dr. Charles Baker has consented to serve in this capacity for 1954.

The luncheon was attended by approximately 300 members who, by their presence, paid tribute to nine honored guests seated at a long table in front of the speaker's table.

A number of members, in expressing themselves to the chairman, stated, "I wish we had a transcription of this meeting." Perhaps it was a story or two that prompted their remarks. At any rate, the following is a fair description of the meeting.

Dr. Brooks Bell, President of the American Association of Orthodontists, called the meeting to order and explained the reason for the luncheon and then presented Dr. Ernest N. Bach, the chairman, who presided from then on.

In his opening remarks Dr. Bach stated, "If I were asked to say a little prayer before starting the next part of our program, I would say something like this: 'God, make us ever humble and thankful for our friends. Teach us to be appreciative of all the things we have and make us ever mindful of those less fortunate than we, remembering that doing things for others and putting others before self will give us the greatest happiness, peace of mind, and contentment of soul as long as we shall live.' "

After relating the purpose of the luncheon meeting and the difficulties encountered in locating members who had graduated fifty or more years ago, he read two poems which are printed by request.

NOW—NOT AFTER

Don't mingle flattering words with sighs
And blessings after I close my eyes,
If deeds of mine have any worth,
Admit it while I'm still on earth,
Don't wring your hands in sheer despair
And moan and groan and tear your hair.
Don't whine regrets upon my head.
For I can't hear you when I'm dead.

What care I for post mortem praise,
That failed to come in living days;
I'd much prefer one word of cheer,
While I'm alive, not at my bier:
If one kind act can ease my sorrow.
Don't put if off until tomorrow,
If you can dry my tears with laughter,
Just do it NOW, don't wait 'til AFTER.

—*Author Unknown.*

AROUND THE CORNER

Around the corner I have a friend
In this great city which has no end;
Yet days go by and weeks rush on,
And before I know it a year has gone;
And I'll never see my old friends's face,
For life is a swift and terrible race.

He knows I like him just as well
As in the days when I rang his bell,
And he rang mine. We were younger then
But now we are busy, tired men—
Tired of playing a foolish game;
Tired with trying to make a name.

"Tomorrow," I'll say "I'll call on Jim,
Just to show that I'm thinking of him."
But tomorrow comes and tomorrow goes,
And distance between us grows and grows.
Around the corner—yet miles away.
"Here's a telegram, Sir"—Jim died today!
And that's what we get and deserve in the end
Around the corner, a vanished friend.

—Charles Hanson Towne

The American Association of Orthodontists is paying a very small tribute and honor to its fifty-year members today instead of tomorrow.

Dr. John Valentine Mershon passed away Feb. 18, 1953, and Dr. E. R. Schroeder died Feb. 20, 1953. All present at the luncheon stood in a moment of silence showing their respect, admiration, and gratitude for having had the privilege of their friendship and association.

After a story or two and a reading about a boy, his girl, and her present, each honored guest was escorted individually to the head table. A short biography of each was then read. This included place of birth, first location in practice, present location, dental fraternities, hobbies, dental college, date of graduation, and the year each joined the American Association of Orthodontists.

Each was presented with a gold label pin bearing the letters "AAO" and the number "50."

Had Dr. Mershon lived, he would have been the oldest member in years of practice, having practiced sixty-four years. The next member is Dr. Norris C. Leonard of Nashville, who has been in practice sixty-three years. From then on it is interesting to note:

1 practiced 61 years
1 practiced 60 years
1 practiced 58 years
2 practiced 57 years
1 practiced 56 years
7 practiced 55 years
4 practiced 54 years
6 practiced 53 years
2 practiced 52 years
4 practiced 51 years
7 practiced 50 years

There are twelve honorary and retired members in this group. For the entire group of fifty-year members, the total number of years since graduation is 2,052 years. The total number of years in active practice is 1,851. Their places of birth represent sixteen states and England. Their places of graduation represent seventeen colleges. Dr. Lloyd S. Lourie is the only living charter member of our association, as well as the first president of the American Association of Orthodontists.

A photograph taken at the luncheon and the gold folder with the fifty-year roster, a five-page letter which gives some of the high lights of the luncheon and excerpts from letters the chairman received from each man, a greeting card signed by those present, and the gold pins have been mailed to all fifty-year men who could not attend. The photograph and gold folders are compliments of the committee.

The second meeting of the G.A.G. (Charlie Baker named it), Golden Anniversary Group, is being planned for the Chicago meeting next May.

The Palmer House in Chicago, where the American Association of Orthodontists will hold its next annual meeting, May 16 through May 30, 1954.

American Board of Orthodontics

The following excerpts are taken from the recently published booklet of information prepared for general information by the American Board of Orthodontics.

Created by the American Society of Orthodontists, 1929, incorporated by State of Illinois, January, 1930.

Directors—1953-1954: Raymond L. Webster, 1955, President, Providence, R. I.; William E. Flesher, 1954, Vice-President, Oklahoma City, Okla.; Lowrie J. Porter, 1958, Treasurer, New York, N. Y.; C. Edward Martinek, 1956, Secretary, Detroit, Mich.; Ernest L. Johnson, 1957, Director, San Francisco, Calif.; William R. Humphrey, 1959, Director, Denver, Colo.; and L. Bodine Higley, 1960, Director, Iowa City, Iowa.

THE AMERICAN BOARD OF ORTHODONTICS

ORIGIN AND AUTHORITY

At the twenty-eighth annual meeting of the American Society of Orthodontists, held in Estes Park, July 16 to 19, 1929, the American Board of Orthodontia* was created under a resolution offered by Dr. Martin Dewey, chairman of the committee which was appointed to consider the President's address, and adopted unanimously. The resolution follows:

"Whereas, the President has recommended the formation of an American Board of Orthodontics similar to the American Board of Otolaryngology and other similar boards formed for the purpose of regulating the specialties of medicine, which boards have rendered valuable service in standardizing and increasing the efficiency of medical specialists; and

"Whereas up to this time those engaged in the practice of orthodontics have had varying and sometimes insufficient qualifications for the practice of our specialty; and

*In 1939 the name was legally changed to the American Board of Orthodontics.

"Whereas, the need of a high order of training is essential to orthodontic practice; and
"Whereas, there is need of a body to designate standards of study and other qualifications for those who are to represent the specialty of Orthodontics; be it therefore
"RESOLVED: That the American Society of Orthodontists create and sponsor an organization to be known as The American Board of Orthodontics, which shall consist of seven men of unquestionable and outstanding reputation and accomplishment in the science of Orthodontics, who shall be appointed by the Executive committee and elected by the general assembly at large—one to serve for a period of one year, one to serve for a period of two years, one to serve for a period of three years, one to serve for a period of four years, one to serve for a period of five years, one to serve for a period of six years and one to serve for a period of seven years; and one to be elected annually thereafter to serve for a period of seven years. The nominations made by the Executive Committee shall not be voted upon until the following day thereafter. Three-fourths of the votes cast shall be necessary to elect a nominee a member of The American Board of Orthodontics.
"The Board shall organize and make rules regarding the requirements for examination of candidates for the granting of certificates of fitness, and to make such other rules and regulations as it may deem necessary for the proper functioning of the Board."

ADDENDUM ON AUTHORITY

Rules and regulations directing the operations of the American Board of Orthodontics are based upon the Requirements of Approval of the Council on Dental Education of the American Dental Association.

This agreement between the Board and the Council was consummated Oct. 27, 1950,

CERTIFICATION BY WAIVER

The Board is committed to an agreement that following its 1953 meeting it will no longer be possible to waive examination and certify candidates on their records.

PURPOSES

First. To stimulate and keep alive the spirit of research and self-improvement among students and practioners of orthodontics.

Second. To establish the competence of specialists to practice orthodontics.

Third. To arrange, control, and conduct examinations for the purpose of testing the qualifications of orthodontists and to confer certificates upon those who meet the established requirements of the Board.

CERTIFICATE—*Not a Degree*

The certificates granted by the Board are in no sense degrees, nor do they purport to confer upon any person any legal qualification, privilege, or license to practice orthodontics, nor does the Board intend to limit the activities of any licensed dentist.

All diplomates are required to understand and agree that titles to certificates are retained by the American Board of Orthodontics, and that such certificates shall be surrendered upon demand by order of the Board, if, and whenever the Board deems such action to be in the best interests of professional and public welfare.

VALUE OF CERTIFICATE

Primarily, it will establish in the mind of the holder the assurance that he is maintaining accredited standards of competency in his practice.

Secondarily, educational or social institutions in which the services of an orthodontist may be required will learn to discriminate standard of fitness in the practice of orthodontics, and will be influenced by the certificate of the American Board of Orthodontics in arriving at conclusions.

Furthermore, the establishment of definite standards of fitness to those anticipating specialization in orthodontics will serve as a genuine stimulus to desire and possess such a symbol of recognition of their ability.

Lists of those holding certificates will be published by the Board from time to time.

WHO MAY APPLY FOR A CERTIFICATE

(NOTE: Changes and modifications may be made in these requirements from time to time.)

The following are eligibility requirements of applicants:

(a) He must have been in the exclusive practice of orthodontics for at least five years at the time of filing application.

(b) In computing this five-year requirement, time spent in special training in orthodontics may be included.

(c) His minimum training requirements shall be:

1. Two years' successfully completed graduate or postgraduate orthodontic training in an accredited university school (this means two academic years each of eight months' or more duration); or

2. Eight months' university graduate or postgraduate orthodontic training in an accredited university school plus (a) twelve months' full time preceptorship in the office of a member of the American Association of Orthodontists, or by spending sufficient time in hospitals, clinics, or fundamental science laboratories recognized by the Council on Dental Education of the American Dental Association and by the American Board of Orthodontics as competent to provide an equivalent adequate training in orthodontics, or (b) twenty-four months' supervisory preceptorship as defined below; or

3. Twenty-four months' full-time preceptorship in the office of a member of the American Association of Orthodontists or its equivalent including the attendance at acceptable special orthodontic courses or in hospitals, clinics, or fundamental science laboratories recognized by the Council on Dental Education of the American Dental Association and by the American Board of Orthodontics as competent to provide an equivalent adequate training in orthodontics; or

4. Twelve months' full-time preceptorship in the office of a member of the American Association of Orthodontists *plus* twenty-four months' supervisory preceptorship or an equivalent to the above which may include the attendance at acceptable special orthodontic courses or in hospitals, clinics, or fundamental science laboratories recognized by the Council on Dental Education of the American Dental Association and by the American Board of Orthodontics as competent to provide an equivalent adequate training in orthodontics; or

5. Forty-eight months' supervisory preceptorship or an equivalent which may include the attendance at acceptable special orthodontic courses or in hospitals, clinics, or fundamental science laboratories recognized by the Council on Dental Education of the American Dental Association and by the American Board of Orthodontics as competent to provide an equivalent adequate training in orthodontics.

(d) Teaching or a fellowship in the field of the specialty may be considered in partial fulfillment of this requirement.

(e) Satisfactory moral and ethical standing in the dental profession.

(f) Citizenship in the United States. A citizen of Canada who meets all other requirements may be eligible to receive an "affiliate certificate."

(g) Graduation from a dental school accredited or otherwise recognized by the Council on Dental Education.

(h) A license to practice dentistry issued by a legally constituted examining board or other legal authority in the United States or Canada.

(i) Membership in the American Dental Association, National Dental Association, or the Canadian Dental Association, and the American Association of Orthodontists.

Membership in the American Association of Orthodontists for at least three years is required before one may take the examination.

DEFINITION OF PRECEPTORSHIPS

1. *A preceptorship* shall consist of full-time association in the office of a member of the American Association of Orthodontists. Such a preceptor would be expected to conscientiously do all he could to determine applicant's ability. He would appraise the extent and quality of records for diagnosis and treatment planning and offer proper suggestions for improvement.

A suitable form will be supplied by the American Board of Orthodontics to be filled in by the preceptor to give full and confidential reports on the applicant.

The director of the American Board of Orthodontics located nearest the applicant should be consulted concerning any preceptorship arrangement to establish eligibility for American Board of Orthodontics certification.

2. *A supervisory preceptorship* shall consist of supervision by a member of the American Association of Orthodontists the same as by preceptor described previously except that the applicant need not be associated in the office of his preceptor.

Identical provisions shall prevail in regard to forms for confidential reports.

APPLICATIONS, FEES, AND ROUTINE

Application for a certificate of qualification must be made on a special form, which may be procured from the secretary, together with other required credentials. These must be filed with the secretary *at least sixty days prior to the next scheduled meeting of the Board.* The application must be accompanied by a fee of one hundred dollars.

The American Board of Orthodontics meets once a year, immediately preceding the annual convention of the American Association of Orthodontists. At this time, it reviews the applications on hand, and approves or rejects them. For all of those approved the Board decides upon the requirements for examination and notifies the applicant accordingly. The applicant is expected to have his material for examination prepared by the next Annual Meeting.

If he is unable to complete these requirements by that time he has the right to petition for an additional year.

Should this additional year be granted and he is still unable to complete the requirements, he has the privilege of requesting a final year in which to do so.

In the event he does not meet his requirements by his final year his application will be cancelled and his fee forfeited.

Should a candidate file his requirements by the required time and fail his entire examination, or any part thereof, he has the privilege of repeating the full examination, or the part failed, one full year after having taken his first examination and before the expiration of five years thereafter.

If, on taking the second examination, he should fail any part thereof, he shall have the privilege of repeating the part failed within the same five-year period.

If he should fail his entire re-examination at this time his application will be cancelled. He may, then, after due preparation, file a new application.

REQUIREMENTS FOR A CERTIFICATE

The requirements for the granting of a certificate of qualification will be stipulated by the Board in each case after a careful study of the record of the applicant. In determining these requirements, complete information regarding the following items is essential:

1. Preliminary education.
2. Dental education.
3. Orthodontic education.
4. Graduate and postgraduate study in orthodontics.
5. Teaching appointments in orthodontics.
6. Time of exclusive practice in orthodontics.
7. Contributions to dental and orthodontic literature.
8. Orthodontic clinics and exhibits.
9. Activities in research.
10. Ethical standing in community and profession.

EXAMINATIONS

Examination of candiates for certificates may include any or all of the following:

One or more theses on subjects satisfactory to the Board.
Case reports, to be prepared according to an outline furnished by the Board.
Sets of casts fitted with appliances suitable for treatment of the cases shown.
Personal visits to offices of applicants.
Written or oral examinations.
Clinical presentations.
Laboratory and technique examinations.

USE OF TITLE "A.B.O."

It is considered injudicious to use the honorary title of American Board of Orthodontics on office signs, stationery, legal and business papers. In general it should not be used with titles of papers and clinics in programs or in their publication.

Professional experience is helpful in determination of appropriatness in use of the title within good taste and ethical concepts.

It may be proper to use the honorary title in connection with authorship of textbooks, educational bulletins listing faculties or, in some instances, with original articles for publications.

(With reference to indirect application of those policies, special regulations apply to theses submitted toward certification.)

THE ALBERT H. KETCHAM MEMORIAL

Established by The American Board of Orthodontics in collaboration with
The American Association of Orthodontists 1936

In the passing of Dr. Albert H. Ketcham on Dec. 6, 1935, the profession sustained an irreparable loss. As one of the pioneers in orthodontics, he helped blaze the trail into the unexplored realms of its science, doing his work so well that the burdens of those to follow were greatly lightened.

As a student and investigator, his wisdom and judgment brought benefits to humanity and general helpfulness to his fellow practioners. No man gave more generously of his time, effort, or ability for the advancement of orthodontics than did Dr. Ketcham. Although handicapped for forty years by physical disabilities, he never faltered in his exacting labors.

To commemorate his achievements, and serve as an inspiration to the advancement of orthodontics, The American Board of Orthodontics created

THE ALBERT H. KETCHAM MEMORIAL

The material symbol of this memorial shall consist of an illuminated parchment, appropriately inscribed, to be awarded annually to an orthodontist or some other person, who in the judgment of the award committee, has made a notable contribution to the science and art of orthodontics during the current year or some previous period, provided, that if in any year a candidate satisfactory to the Ketcham award committee is unavailable the award shall not be made in that year.

AWARDS

1937 John Valentine Mershon, Philadelphia, Pa.
1938 Alfred Paul Rogers, Boston, Mass.
1939 Milo Hellman, New York, N. Y.
1940 George Wellington Grieve, Toronto, Canada.
1941 Frederic B. Noyes, Chicago, Ill.
1942 Harry E. Kelsey, Baltimore, Md.
1944 Holly Broadbent, Cleveland, Ohio.
1946 Raymond C. Willett, Peoria, Ill.
1948 Clinton C. Howard, Atlanta, Ga.
1949 William King Gregory, New York, N. Y.
1951 Benno E. Lischer, St. Louis, Mo.
1952 James D. McCoy, Beverly Hills, Calif.
1953 Spencer R. Atkinson, Pasadena, Calif.

Central Section of the American Association of Orthodontists

The Central Section of the American Association of Orthodontists now has a newsletter. The following news items are quoted from the newsletter.

PRESIDENT'S MESSAGE

"We in Chicago are looking forward with pleasure to the Sixteenth Annual Meeting of our Central Section. Every effort is being made to assure you and your wife a very enjoyable as well as profitable two days at the Edgewater Beach Hotel on October 19 and 20, 1953. I wish to take this opportunity to extend a personal invitation to each one of you and may I suggest that you make your plans now and write the Hotel for reservation."

G. HEWETT WILLIAMS

"The Program Committee is attempting to develop a theme of Clinical Application of Recent Diagnostic Aids for Treatment of Dento-Facial Anomalies. At this writing we have the acceptance of two essayists who will occupy the entire afternoon. Monday the Chicago Association of Orthodontists will furnish the Central Section with a guest speaker, Dr. Alexander Sved, who will present a paper on 'A Critical Review of Cephalometrics.'

"Tuesday morning at 9 o'clock will be a treatment forum. Tuesday afternoon will be devoted to the clinics.

"We are sure we will have a solid two-day meeting and we trust it will be most interesting and instructive."

HOWARD YOST, CHAIRMAN
WILLIAM F. FORD
GRORGE A. DINHAM

Last Annual Meeting Briefs

"The last Annual Meeting of Central Section of the American Association of Orthodontists was held on October 13 through October 14, 1952 at the Hotel Fontenelle, Omaha, Nebraska, with Dr. E. E. Shepard, Vice-President, presiding. Due to the recent untimely death of Dr. Paul G. Ludwick, our elected President, Dr. E. E. Shepard presided.

"Eight new members were elected to active membership status in Central Section of the American Association of Orthodontists. Ten new members were elected to associate status in Central Section; their names appear elsewhere in this letter.

"Central Section and the American Association of Orthodontists sustained a great loss in the passing of Dr. Paul G. Ludwick, Lincoln, Nebraska, and Dr. Herbert C. Haberle, Hinsdale, Ill.

"The following amendment to our by-laws, presented at the last Annual meeting in 1951, was acted upon favorably at this meeting.

> 'In the event of a vacancy in the office of president-elect, the office of president for the ensuing year shall be filled at the next annual session in the same manner as provided for the nomination and election of officers, except that the person so elected shall assume the office of president at the close of the annual session at which he is elected.'

"New Officers elected were:

President Elect	Dr. Earl E. Shepard St. Louis, Missouri
Vice-President	Dr. Howard Yost Grand Island, Nebraska
Secretary-Treasurer	Dr. Fredrick B. Lehman Cedar Rapids, Iowa
Member of Board of Censors	Dr. Elmer Bay Omaha, Nebraska
Member of Publication Board	Dr. Wm. S. Brandhorst St. Louis, Missouri
Judicial Council	Dr. Donald M. Mehrens Sioux Falls, S. D.
Representative to the A.A.O. Board of Directors	Dr. Cecil B. Mueller Omaha, Nebraska
Alternate	Dr. S. J. Kloehn Appleton, Wisconsin

"Appointed Committees:

Nominating Committee

C. S. Foster, ch.	Cedar Rapids, Iowa
P. M. Dunn	Minneapolis, Minn.
Harlan New	Park Ridge, Ill.

Budget Committee

Ralph Bengston, ch.	Chicago 2, Ill.
Elmer Bay	Omaha, Nebraska
Max Kadesky	Dubuque, Iowa

Necrology Committee

Charles Baker, ch.	Evanston, Ill.
Joe M. Pike	Minneapolis, Minn.
A. B. Thompson	Des Moines, Iowa

Local Arrangements

Harlan New, ch.	Park Ridge, Ill.
Abe Goldstein	Chicago 2, Ill.
John McGuire, Jr.	Evanston, Ill.
Howard Strange	Chicago 49, Ill.
Karl Von der Heydt	Oak Park, Ill.

Program Committee

Howard Yost, ch.	Grand Island, Nebraska
George Dinham	Duluth, Minn.
W. F. Ford	Chicago 2, Ill.

Clinic Program

W. F. Ford, ch.	Chicago 2, Ill.
R. K. Ephland	Park Ridge, Ill.
Wm. S. Bradford	Highland Park, Ill.

New Members

"We wish to take this opportunity to welcome the following new active members in Central Section and the American Association of Orthodontists.

Dr. Wade R. Plater	Madison, Wisconsin
Dr. L. W. McIver	Minneapolis, Minn.
Dr. Max Kuharich	Chicago 31, Illinois
Dr. Albert Leon Miller	Kansas City 2, Mo.
Dr. Wm. S. Bradford	Highland Park, Ill.
Dr. Richard H. Bowlin	Keokuk, Iowa
Dr. Virgil C. Wanezek	Sheboygan, Wisconsin
Dr. H. Carlyle Pollock, Jr.	Clayton 5, Mo.

"We wish also to welcome the following as associate members in Central Section and urge them to apply, when qualified, through the Secretary for active membership in the Section and the A.A.O.

Dr. Arthur John Block	Chicago 49, Ill.
Dr. LeRoy Paul Krause	Mitchell, S. D.
Dr. Velma P. Brown	University City 5, Mo.
Dr. Roger John Fredsall	Minneapolis, Minn.
Dr. Richard C. Thometz	Chicago 44, Ill.
Dr. Harry J. Kent	Chicago 25, Ill.
Dr. Robert B. Norris	Clinton, Iowa
Dr. George L. Fraseur	Spencer, Iowa
Dr. Wm. Donald Reynolds	Chicago 20, Ill.
Dr. Robert L. Williams	Chicago 40, Ill.

Secretary's Column

"Your Secretary feels there exists a degree of confusion on the part of many of our members in regard to active membership status and associate membership status and the manner of applying for each. The following information, it is hoped, will help in clarifying these misunderstandings:

"1. A prospective member regardless of age, years in exclusive practice of Orthodontics, or the degree of training, must first become an Associate Member for at *least one year* before making application for Active Membership.

"2. Associate membership constitutes membership only in the Sectional Society, in which he resides. An associate member does not hold membership in the A.A.O. nor does he automatically receive the Journal of the American Associa-

tion of Orthodontists. Associate membership in effect is a probation period before becoming eligible for active membership in the American Association of Orthodontists.

"3. Associate members shall have all the privileges of the Sectional Society (only) except the right to vote and hold office. This does not include the privilege of attending the A.A.O. meeting without paying a registration fee. Presentation of the associate membership card is also required. This does *not* imply that associate members are not welcome to A.A.O. meetings, however.

"4. Associate members applying for active membership must have two endorsers sign their application blank accompanied by letters of recommendation by these endorsers. This procedure applies also for those individuals seeking associate membership. Separate blanks for each category are available from your Secretary.

"5. ALL APPLICATIONS TOGETHER WITH LETTERS OF RECOMMENDATION *MUST* BE IN THE HANDS OF THE SECRETARY AT LEAST 60 DAYS PRIOR TO THE ANNUAL MEETING. This is necessary to enable each member of the Board of Censors to check the applications and to also allow time for inserting the names in the program.

"6. Please check your copy of the By-Laws for minimum eligibility requirements for each status of membership.

"Your Secretary is attempting an improvement in the Section's records and wishes your cooperation by filling in the questionnaire and forwarding it to him at your earliest opportunity.

FREDRICK B. LEHMAN
SECRETARY-TREASURER"

American Institute of Dental Medicine

The Tenth Annual Meeting of the American Institute of Dental Medicine will be held at the Desert Inn and El Mirador, Palm Springs, Calif., Oct. 25 through Oct. 29, 1953. Advance registration, according to an announcement by Dr. Hermann Becks, Director and Founder of the Institute, indicates a capacity turnout for the five-day study session. Included in the program to be discussed and analyzed at the meeting are the following subjects:

W. L. Bostick, M.D., University of California, San Francisco, Calif.: Dynamics of Inflammation, Cellular Reaction to Injury, and The Malignant Lymphoma.

A. C. Curtis, M.D., University of Michigan, Ann Arbor, Mich.: The Physiology of Pigmentation in Man, Cutaneous Virus Diseases, and The Dentist Looks at the Field of Dermatology.

H. B. G. Robinson, D.D.S., University of Ohio, Columbus, Ohio: The Oral Pathologist Considers Focal Infection, Clinical Aspects of Intraoral Ageing, and Recalcitrant Diseases of the Oral Mucosa.

D. B. Scott, D.D.S., National Institutes of Health, Bethesda, Md.: The Structure of Normal Dental Tissues as Observed Under the Electron Microscope, Electron Microscopy of Carious Enamel and Dentin, and The Influence of Structural Variation on Current Histological Concepts.

H. Selye, M.D., Ph.D., University of Montreal, Montreal, Canada: The Alarm Reaction, The General Adaptation Syndrome, and The Role of Stress and of the Adaptive Hormones in Dental Medicine.

H. Sicher, M.D., Loyola University School of Dentistry, Chicago, Ill.: Anatomic Basis for the Spread of Dental Infections, Problems of Pain in Dentistry, and Common Misconceptions in Genetics.

These and other subjects along the same lines will be discussed and all Seminar lecturers will participate in a round-table forum covering the application of the subjects to the practice

of dental medicine. Applications and full information on the Seminar program may be secured by writing Miss Marion G. Lewis, Executive Secretary, 2240 Channing Way, Berkeley 4, Calif.

University of Pennsylvania

The Graduate School of Medicine of the University of Pennsylvania announces a new and longer course in orthodontics, under the direction of Dr. Paul V. Reid, to be given commencing Sept. 9, 1953, and running for sixteen consecutive months. Clinical instruction will be given by the staff in the larger and newly equipped department of the Evans Dental Institute. The facilities of the Growth Center of the Childrens Hospital of Philadelphia also are utilized under the direction of Dr. Wilton M. Krogman. Other collateral studies are given by members of the faculties of both the School of Dentistry and the Graduate School of Medicine. Dentists who successfully complete this sixteen-month course may matriculate for the degree of Master of Dental Science under the preceptorship plan of the University. For further information, write to the Dean, Graduate School, School of Medicine, 237 Medical Laboratories, Philadelphia 4, Pa.

University of Minnesota Oral Medicine Seminar

The University of Minnesota announces the Eighth Annual Oral Medicine Seminar, to take place Sept. 17, 18, and 19, 1953, at the Center for Continuation Study.

Further information may be obtained by writing to the Director, Center for Continuation Study, University of Minnesota, Minneapolis 14, Minn.

Notes of Interest

Lloyd L. Cottingham, D.D.S., formerly of Beverly Hills, announces his return from active duty with the United States Air Force and his association with Harvey Stallard, Ph.B., Ph.D., D.D.S., practice limited to orthodontics, 803 Medico-Dental Bldg., San Diego, Calif.

Arlo M. Dunn, B.Sc., D.D.S., announces the removal of his office from 939 Medical Arts Bldg. to his new building, 5015 Dodge Street, Omaha, Neb., practice limited to orthodontics.

Theodore Adler, D.D.S., announces the opening of his office for the exclusive practice of orthodontics at 203 Mamaroneck Ave., White Plains, N. Y.

Archie B. Brusse, D.D.S., announces the association of H. Carlyle Pollock, Jr., D.D.S., recently discharged from active duty with the United States Army Dental Corps, practice limited to orthodontics, 1558 Humboldt, Denver 18, Colo.

OFFICERS OF ORTHODONTIC SOCIETIES

The AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

American Association of Orthodontists

President, James W. Ford - - - - - - - - - 55 E. Washington St., Chicago, Ill.
President-Elect, Frederick T. West - - - - - - 760 Market St., San Francisco, Calif.
Vice-President, George M. Anderson - - - - - - - 831 Park Ave., Baltimore, Md.
Secretary-Treasurer, Franklin A. Squires - - - - - Medical Centre, White Plains, N. Y.

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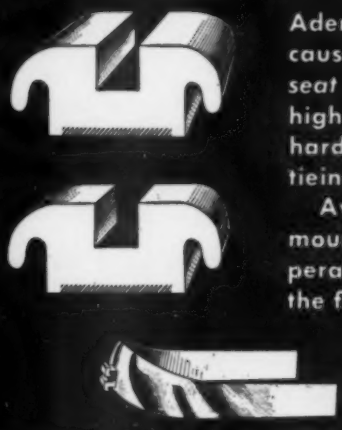

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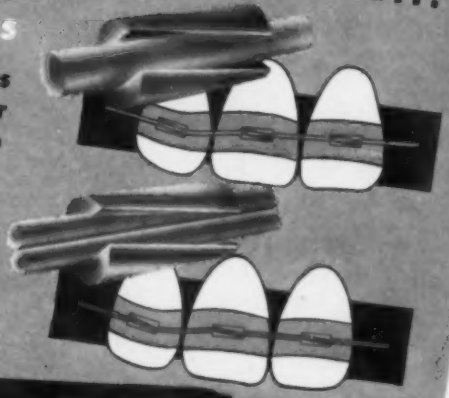

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Main subjects:

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Speakers: Prof. A. M. Müller, Basel; Prof. E. Wannenmacher, Owingen; Dr. M. Schug-Kösters, München; Doz. N. Möse, Graz; Prof. Münch, Asst. R. Waechter, Graz; Dr. A. Mayer, Dachau; Dr. Haunfelder, Würzburg.

PROSTHETICS: (a) "Improvement of Technique With Acrylic Material in Dentistry."

Speakers: Prof. Falck, München; Prof. R. Grohs, Wien; Doz. N. Uhlig, Kiel; Prof. A. Schröder, Basel.

(b) "Retainer for Bridge Work."

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Speakers: Prof. G. Korkhaus, Bonn; Prof. K. Häupl, Düsseldorf; Prof. F. Ascher, München; Prof. M. Schwarz, Wien; Doz. L. Patrik, Wien; Dr. R. Bay, Basel; Dr. N. Eschler, Freiburg i.B.; Prof. R. Trauner, Graz; Asst. Marschang, Innsbruck; Doz. Hauser, Bonn; Dr. Ziedrich, Graz; Dr. Clar, Graz.

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